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ABSTRACT

This document is an instructional module package designed in the objective format for use by an instructor familiar with pre-treatment unit operation. Included are objectives, instructor guide, student handouts and transparency masters. The module considers design, operation, maintenance, and safety of common methods of grit removal, screening, grinding, flotation and preaeration. (Author/RH)

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PRE-TREATMENT

Training Module 2.102.2.77

Prepared for the

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by

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September, 1977

SE 024 026

The mention of trade names, or use of manufacturers technical bulletins, diagrams depicting specific equipment, or the commercial product in this module is for illustration purposes, and does not constitute endorsement or recommendation for use by Kirkwood Community College nor by the Iowa Department of Environmental Quality.

SUMMARY

Module No:	Module Title: Preliminary Treatment
Approx. Time:	Submodule Title: 1. Grit Removal 2. Screening/Comminutors 3. Flotation 4. Preaeration

Overall Objectives:

Upon completion the student will be able to:

1. Identify method and equipment used in grit removal.
2. Identify methods of dewatering.
3. Identify parts of a bar screen.
4. Identify parts of a comminuter.
5. Identify process of flotation and purpose.
6. Identify process of preaeration and purpose.

Instructional Aids:

Handouts
Overheads
Suggested: Plant O & M Guide

Instructional Approach:

Discussion
Lecture
Optional: Field trip and demonstration

References:

1. WPCF MOP #8
2. Wastewater Engineering, Metcalf and Eddy Inc.
3. WPCF MOP #11
4. Operation of Wastewater Treatment Plants, Sacramento
5. Manufacturer's literature

Class Assignments:

Read handouts
Label diagrams
Parcipate in discussions

Module No:	Topic: SUMMARY

Instructor Notes:	Instructor Outline:
Instructor: This entire module has been researched from many souces. Please note the sources and become familiar with them. 1. Handouts Most handouts are of a dual nature. These may be copied on a transparancy and used as an overhead. 2. The field trip mentioned is optional. Recommended if the specific process/equipment mentioned is in the nearby area. 3. Student may supply O & M manufacturers information for further resource material in the workshop. 4. The instructor is expected to add personal experiences, changes and deletions to the module based on personal experience. 5. Disposal methods mentioned in the last part of this module are only a few of the techniques available. These techniques will be the most common. Suggestion on this section will be to have students check out local ordinances covering this area.	Objective: The student will be able to recognize the importance of pretreatment in wastewater. The properly operated and maintained preliminary portion of the treatment process will be the key to a well operated biological process by not overloading with excess materials. Handouts of equipment and process equipment are examples or guides. Instructor should get recent literature from appropriate manufacturers.

LIST OF HANDOUTS

1. Screening Equipment
2. Link Belt Screen/Grinder Service Instruction
3. Comminuter
4. Grinder Maintenance
5. Barminuter
6. Fine Screens Operation Parts Maintenance
7. Fine Screen Side View

Preaeration

1. Circulation Pattern of Aeration Tanks
2. Pre-aeration/Primary Unit Cretaway

Flotation

1. DAF System - Also can be used to describe vacuum system
2. Side view of DAF
3. Same
4. Flotation Units - Advantages/Disadvantages

Manufacturers

1. List of Manufacturers

Disposal Methods

1. Methods

Module No:	Module Title: Preliminary Treatment
	Submodule Title: Grit Removal
Approx. Time: 1 hour	Topic: Introduction

Objectives:

Upon completion of this module the student will be able to:

1. Discuss purpose for grit removal.
2. List the characteristics of grit.
3. Describe where a grit chamber should be placed (written).

Instructional Aids:

Instructional Approach:

Lecture
Discussion

References:

1. WPCF MOP #11
2. WPCF MOP #8

Class Assignments:

Review class notes

Module No:	Topic: Introduction to Grit Removal

Instructor Notes:	Instructor Outline:
1. Damage to mechanical equipment pipes and valves reduce digester cleaning frequency. 2. Egg shells, coffee grounds street wash (sand) and other abrasive sources. 3. Heavy suspended mineral matter present in waste-water. 5. Ahead of all mechanical equipment e.g. screen, grit chamber, comminuter.	A. Introduction to Grit Removal 1. Why remove grit 2. Where does grit come from 3. Define 4. Characteristics a. Non-putrescible b. Subsiding velocities greater than organic matter 5. Placement of units

Module No: _	Topic: Introduction to Grit Removal

Instructor Notes:	Instructor Outline:
6. a. Gravity Weight of particle causes removal or deposition. The redirection of velocity to 1 FPS ± FPS. An increase or decrease of this velocity will create non-settling of grit, organic deposition respectively. Normal expected removal size of particle is measured by its specific gravity (S.G.) Comparison of grit S.G. is that of silica sand 2.65.	6. Types of removal processes a. Gravity b. Aerated

Module No:	Module Title: Preliminary Treatment
	Submodule Title: Grit Removal
Approx. Time: 1½ hour	Topic: Removal Processes

Objectives:

Upon completion of this module the participant will be able to:

1. Identify the types of grit removal processes.
2. Describe how grit is removed from chamber.

Instructional Aids:

Handout 1
Handout 2

Both can be overheads

Instructional Approach:

Lecture
Discussion

References:

1. WPCF MOP #8
2. Operation of Wastewater Treatment Plants, Sacramento
3. Manufacturers guide

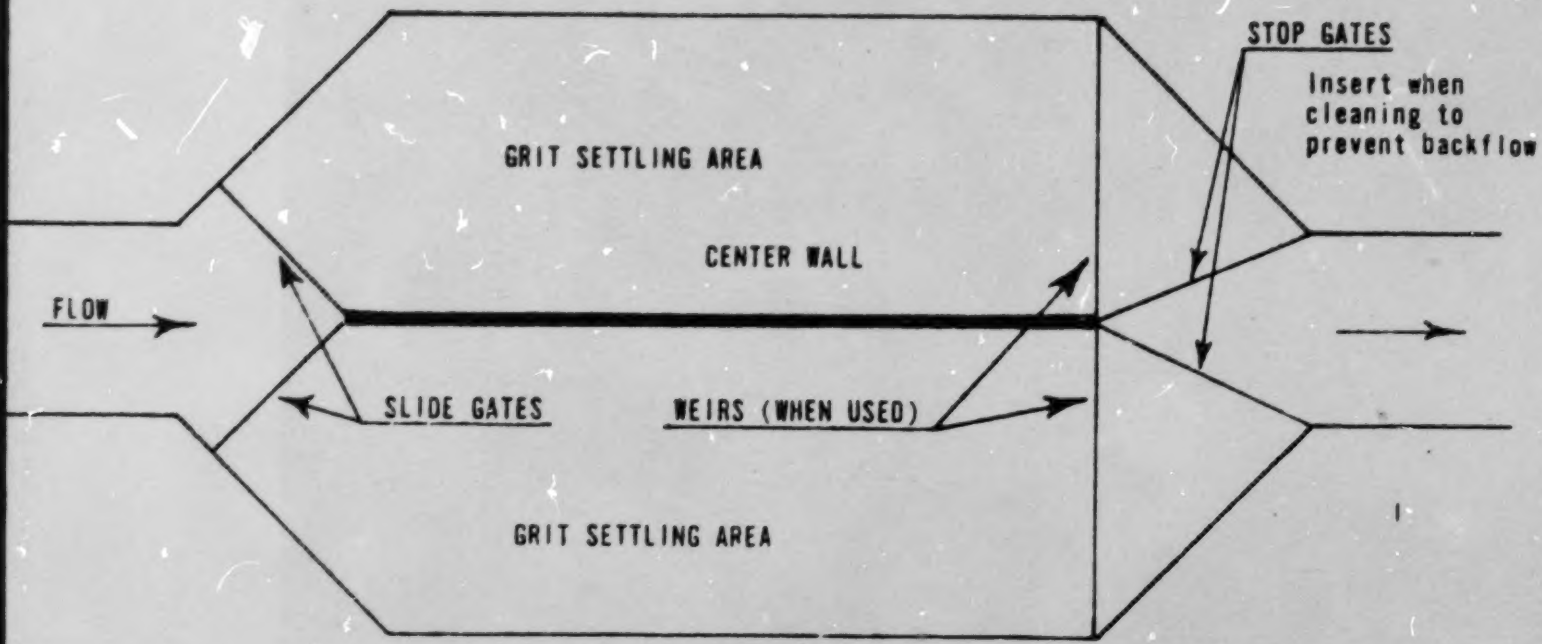
Class Assignments:

Participate in class discussion.

Module No:	Topic:

Instructor Notes:	Instructor Outline:
1. a. Necessary to have two parallel systems in order to allow for cleaning one and collecting grit in the other. Handout - Schematic of Manual System- #1 This system is cleaned by means of hard work. Shovel the grit out and deposit the grit in a landfill or other approved location. Handout - Mechanical System #3 b. Buckets or scrapers are used to pick up the grit from under the water flow and bring the material deposited on the channel bottom back against the direction of flow to elutriate (wash out organics) the grit. The electniated grit is now removed from the flow by a dewatering device. (Discuss later). The system is usually placed on a timer to control collection.	1. Cleaning methods a. Manual b. Mechanical

Handout 1



Grit Chamber

Page 9

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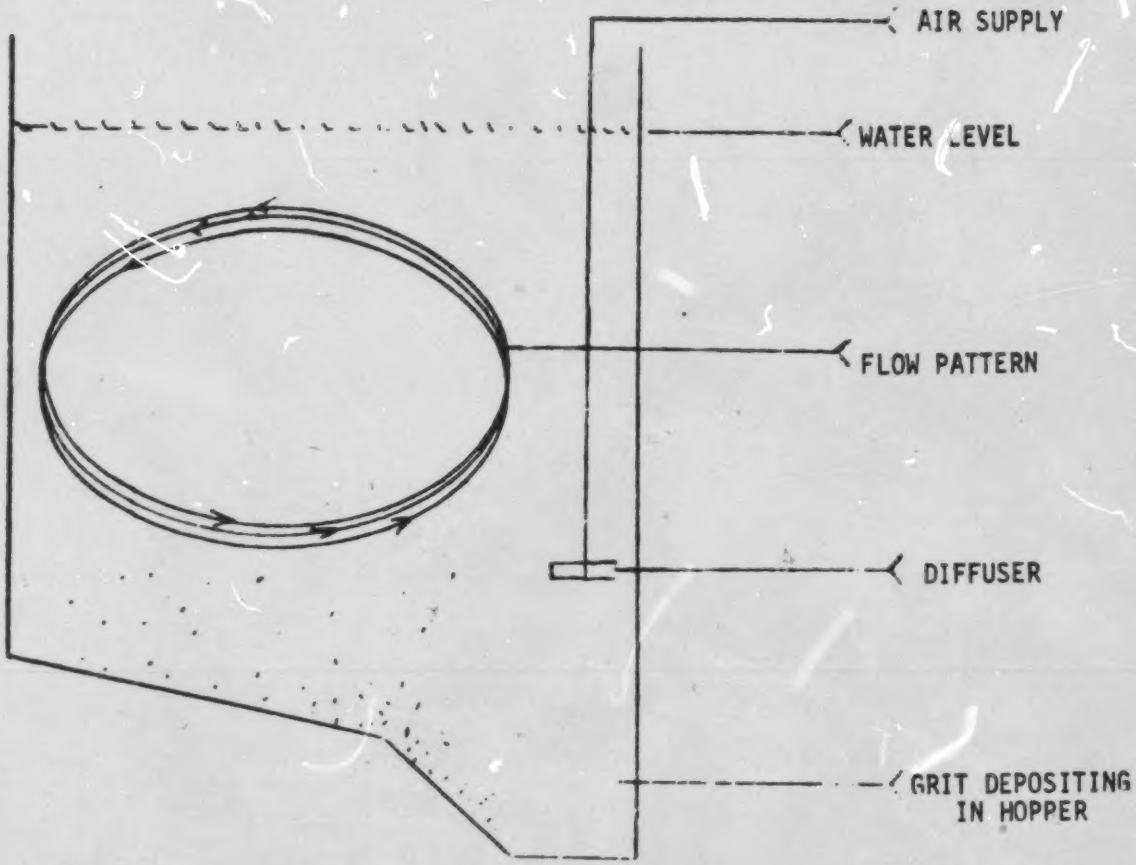
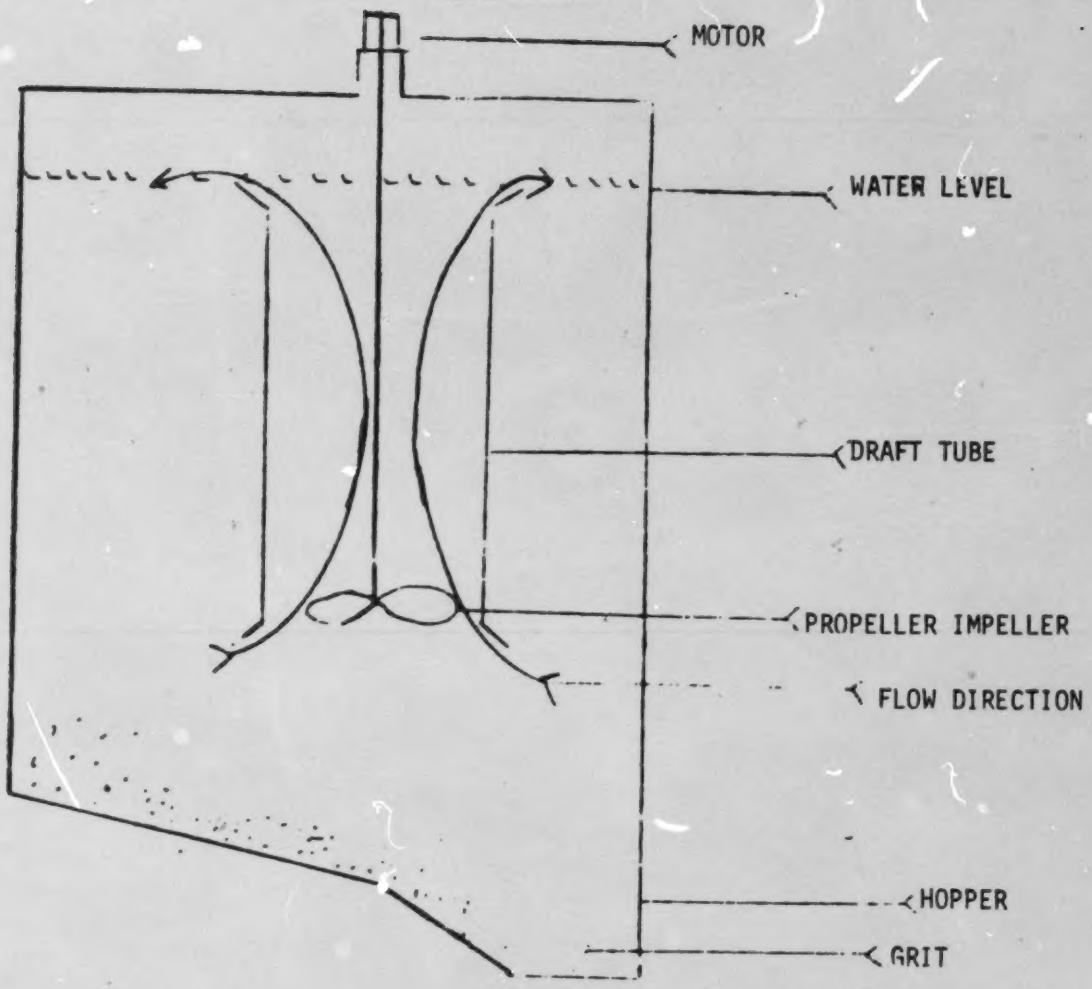
Handout 3



AEREATED GRIT HOPPER

MECHANICAL GRIT SEPARATION



Module No:	Module Title: Preliminary Treatment
	Submodule Title: Grit Removal
Approx. Time: 1.5 hrs	Topic: Flow Factors

Objectives:

The participant will be able to;

1. List/describe the factors effecting settling
2. measure flow through a rectanguler grit chamber

Instructional Aids:

Blackboard

Instructional Approach:

Lecture

Discussion

References:

WPCF MOP #8
WPCF MOP #11

Class Assignments:

Participate in class discussion

Module No:	Topic: Flow Factors

Instructor Notes:	Instructor Outline:
2. Flow factor of 1.0 to 1.25 FPS maximum critical control flow by means of effluent weir.	2. Design flow control
3. a. Bottom scour of deposited material will reduce the effectiveness of removal. b. Turbulence - Reduction of this problem is by designing a transition zone to slow down flow to 1.0 fps. c. Coalescence of particles is not a major factor because of the shallow depth of the channel. Short detention times and the nature of the material. Indication of this would be excessive organics embedded in the grit.	3. Factors affecting flow/settling a. Scour b. Turbulance c. Coalescence of particles
4. A piece of wood whose length is 2/3 the depth of the channel. Weight it to float vertically with 2-3" of the board above the surface. Pick two points in the channel and time the float. Use formula: $r = \frac{d}{t}$ r = Flow velocity d = Distance t = Time	4. Method of Determining Flow Velocity

Module No:	Module Title: p Preliminary Treatment
	Submodule Title: Grit Removal
Approx. Time: 45 min.	Topic: Grit Sources

Objectives:

The student will be a ble to;

List 7 of the 11 listed in the lecture

Instructional Aids:

Handout 4

Instructional Approach:

Lecture

Discussion

References:

WPCF MOP #8
WPCF MOP #11
Operation of Wastewater Treatment Plants - Sacramento

Class Assignments:

Participate in discussion
Review notes and handouts

Module No:	Topic: Quantities of grit Sources
Instructor Notes:	Instructor Outline:

3. Quantities of grit removed in each system are similar with the quality of grit higher in the aerated system.

   Sources of grit are:

   a. Type of street surface

   b. Relative area served

   c. Climate conditions

   d. Types of catch basins

   e. Maintenance of catch basins

   f. Sewer grades

   g. Storm water diverted to system

   h. Construction and condition of sewer

   i. Ground and ground water characteristics

   j. Industrial wastes

   k. Relative use of household grinders

Handout 4

Sources of Grit –

a.

b.

c.

d.

e.

f.

g.

h.

i.

j.

k.

Module No:	Module Title: Preliminary Treatment
	Submodule Title: Grit Removal
Approx. Time: ½ hour	Topic: Mechanical Equipment

Objectives:

The student will be able to:

1. Label schematic of unit principal parts.

Instructional Aids:

Handout 2
Handout 3

Instructional Approach:

Lecture
Discussion

References:

Manufacturers brochure

Class Assignments:

Review handout
Participate in discussion

Module No:	Topic: Mechanical Equipment

Instructor Notes:	Instructor Outline:
Handout of Grit Equipment From Link Belt	Mechanical equipment - nomenclature a. Electric motor b. Longitudinal flights c. Cross flights d. Drive mechanisms e. Sprockets f. Chains

Module No:	Module Title: Preliminary Treatment
	Submodule Title: Grit Removal
Approx. Time: 1½ hours	Topic: Start up of Manually/Mechanically Cleaned Units

Objectives:

The student will be able to:

1. Describe the operations for starting either manual or mechanical cleaning equipment.
2. Describe the abnormal characteristics ascribed to this process.

Instructional Aids:

None

Instructional Approach:

Lecture
Discussions

References:

WPCF MOP#8
Manufacturers material
Several O & M Manuals of typical distillations
Operating Wastewater Treatment Plants - Sacramento

Class Assignments:

Participate in class discussions

Module No:	Topic: Start-Up of Manually/Mechanically Cleaned Units
Instructor Notes:	Instructor Outline:

4. Start up

   a. Manually and mechanically cleaned start the same

      1. Open influent gate slowly.

      2. Open effluent gate when flow reaches it.

      3. Protect mechanical equipment by placing the gear in operation as wastewater starts to cover the longitudinal collectors.

      4. Start all peripheral equipment

      5. Normal operation - mechanically cleaned

         a. Longitudinal collectors set to operate at slow speed to prevent bottom scour and allow for elutriation

         b. Determine collection for removal rates at selected flow rates.

         c. Inspect equipment Regularly (3 x's per) a min.) to determine:

            Grit removal quantities need for repair preventive maintenance. If additional channel is required.

      6. Manually cleaned - normal operation

         a. Measure grit level by draining unit of wastewater daily. Do only at low flow period.

         b. When grit level reaches given quantity take channel out of service and place alternate into service.

         c. Keep sluice gates clean and

Module No.	Topic: Start-Up of Manually/Mechanically Cleaned Units
Instructor Notes:	Instructor Outline:

d. Do not allow grit to stay in channel as organics will putrify and odors and decay will start. Remember H_2S will attack concrete walls of channels.

7. Abnormal operation

a. Rainfall - Infiltration to sewer l

b. Flooding - Infiltration to sewer l and plant.

c. Freezing to channel walls sluice gates and other appurtenances.

Module No:	Module Title: Preliminary Treatment
	Submodule Title: Grit Removal
Approx. Time: 1 hour	Topic: Maintenance of Equipment

Objectives:

The student will be able to:

1. Prepare a simple maintenance program for the unit.

Instructional Aids:

Handout 3 -- optional

Instructional Approach:

Lecture

References:

Manufacturer's brochure
Plant O & M Manuals
WPCF MOP #11
Operations of Wastewater Treatment Plants - Sacramento

Class Assignments:

Participate in class discussions

Module No:	Topic: Maintenance of Equipment
Instructor Notes:	Instructor Outline:

9. Maintenance Equipment
   a. Electrical motors
      1. Bearing R & R. as needed
      2. R & Rq. defective motor
   b. Longitudinal flights
      1. Straighten if bent
      2. Clean of rags - improve collection
      3. Tighten/replace bolts on collector
   c. Cross flights - Follow b
   d. Drive mechanisms
      1. Oil or grease as per mfg. guide
      2. Check for wear in gears
      3. Replace oil as required
   e. Sprockets
      1. Check for chips
      2. Grease to prevent wear damage
      3. Check key way
      4. Check weekly for cracks in sprocket hub. Repair immediately.
      5. Chains
         a. Grease frequently
         b. Check, repair and replace broken or loose links
         c. Check for proper alighment on sprocket.

Module No:	Module Title: Preliminary Treatment
	Submodule Title: Grit Removal
Approx. Time: 15 minutes	Topic: Safety

Objectives:

The student will:

1. Demonstrate the proper safe procedures for work around the unit.

Instructional Aids:

Plant tour

Instructional Approach:

Plant tour

References:

WPCF MOP#8

Class Assignments:

Plant tour

Module No:	Topic: Safety
Instructor Notes:	Instructor Outline:

10. Safety Procedures

    a. Keep walkways free of grease, salts and equipment.

    b. If a deep channel, follow safety precautions for entering deep channels.

Module No:	Module Title: Preliminary Treatment
	Submodule Title: Grit Removal
Approx. Time: ½ hour	Topic: Aerated Units

Objectives:

The student will:

1. Draw and label schematic plan of an aerated unit

Instructional Aids:

Handout 2
Handout 4

Instructional Approach:

Lecture
Discussion

References:

WPCT MOP #8
WPCF MOP #11
Operation of Wastewater Treatment Plants - Sacramento

Class Assignments:

Participation in discussion
Review handout

Module No:	Topic: Aerated Units

Instructor Notes:	Instructor Outline:
1. A detention time of approximately 3 min. in the unit is at maximum flow. The locating of the air diffuser is on the same side as the grit hopper about 18-24 inches above the hopper. Velocity of rolling air is the factor in quantity of grit removed. The greater the velocity the less grit removed. Wastewater will be introduced to the flow in the unit in the direction of the flow. Grit is removed by means of drag buckets or tubular conveyors. Approximately 3.0 CFM/ft. of length of chamber for shallow installations 8-15 ft. Handout of System	1. Aerated

Module No:	Module Title: Preliminary Treatments
	Submodule Title: Grit Removal - Aerated
Approx. Time: ½ hour	Topic: Normal Operation - Abnormal Operation

Objectives:

The student will be able to:

1. List proceedures of start-up of unit.
2. List three factors of abnormal operation

Instructional Aids:

Handout 4
Handout 2

Instructional Approach:

Lecture
Discussion

References:

MOP #8
Operation of Wastewater Plants - Sacramento
Wastewater Engineering - Metcalf & Eddy

Class Assignments:

Participation in discussion

Review handouts

Module No:	Topic: Normal Operation - Abnormal Operation
Instructor Notes:	Instructor Outline:

A. Normal Operation

Open influent gate

Allow flow to cover diffuser by 3 ft.

Turn on air supply system

Removal of grit from unit will be based on quantity in system

Keep record to determine rate of removal

B. Abnormal Operation

High grit quantity due to storm or infiltration.

Remove grit more frequently from unit

Rolling action not as visible

Clean diffuser plate

Odorous grit

Remove more frequently

Check air flow to the unit

Test for organic levels

Module No:	Module Title: Preliminary Treatment
	Submodule Title: Grit Removal - Aerated
Approx. Time: 15 minutes	Topic: Parts of Unit

Objectives:

The student will be able to:

1. List parts common to the unit.

Instructional Aids:

Instructional Approach:

Lecture

References:

Plant O & M Manuals
Manufacturer's brochures

Class Assignments:

Participate in class discussions

Module No:	Topic: Parts of Unit

Instructor Notes:	Instructor Outline:
Blower supplies the air to the system Diffuser creates the rolling action in the unit	C. Main parts Blower Diffuser Grit collection Drive Flights Sprockets

Module No:	Module Title: Preliminary Treatment
	Submodule Title: Grit Removal - Aerated
Approx. Time: 15 minutes	Topic: Maintenance

Objectives:

The student will be able to:

1. Develop a maintenance plan for their own unit.

Instructional Aids:

Instructional Approach:

Lecture

References:

Plant O & M Manuals

Class Assignments:

Participate in discussions

Module No:	Topic: Maintenance
Instructor Notes:	Instructor Outline:

D. Maintenance

Clean diffuser every six months

For blower follow manufacturers guide

Grease grit upper sprocket and drive unit weekly

Module No:	Module Title: Preliminary Treatment
	Submodule Title: Grit Removal - Aerated
Approx. Time: 15 minutes	Topic: Safety

Objectives:

The student will be able to:

1. Use safe practices aroung aerated units.

Instructional Aids:

Instructional Approach:

Lecture
Discussion

References:

UPCF MOP#8
Operation of Wastewater Treatment Plants - Sacramento

Class Assignments:

Participate in discussion

Module No:	Topic: Safety

Instructor Notes:	Instructor Outiine:
	E. Safety Prevent flips and falls. A dangerous area due to the rapid air movement. Depth of unit requires draining of tank to repair unit. Clean unit thoroughly before entering.

Module No:	Module Title: Preliminary Treatment
	Submodule Title: Grit Removal - Dewatering
Approx. Time: ½ hour	Topic: Devices

Objectives:

The student will be able to:

1. List main parts of the unit (screw).
2. Name both methods of dewatering.

Instructional Aids:

Handoug 5 and 6

Instructional Approach:

Lecture
Discussion

References:

Manufacturer's brochures
Plant O & M Manual

Class Assignments:

Participate in discussion

Module No:	Topic: Grit Removal - Dewatering

Instructor Notes:	Instructor Outline:
Handout 5	I. Dewatering devices (classifiers) A. Methods of classification 1. Screw 2. Cyclone 1. Screw a. Main parts Screw pump Submerged bearing Trough Reducer Motor b. Maintenance Screw pump requires minimal attention as a single part. Submerged bearing is to be greased daily to prevent grit becoming inbedded in bearing. Trough wear to this is due to misalignment of the pump unit itself. Reducer - grease weekly. Replace oil in unit yearly. Motor check for wear or strange noise from bearing

Module No:	Module Title: Preliminary Treatment
	Submodule Title: Grit Removal - Dewatering
Approx. Time: 45 minutes	Topic: Normal Operation/Abnormal Operation

Objectives:

The student will be able to:

1. Distinguish between normal and abnormal operation.

Instructional Aids:

Instructional Approach:

Lecture
Discussion

References:

Plant O & M Manuals
Manufacturers brochures

Class Assignments:

Participate in discussion

Module No:	Topic: Normal Operation/Abnormal Operation
Instructor Notes:	Instructor Outline:

B. Normal operation

Grit pump and mixing device to stir up grit into solution "on."

Turn on screw and check for free turning.

Test to see if grit does not go over weir.

Prevent odors.

Follow specific procedures of manufacturer.

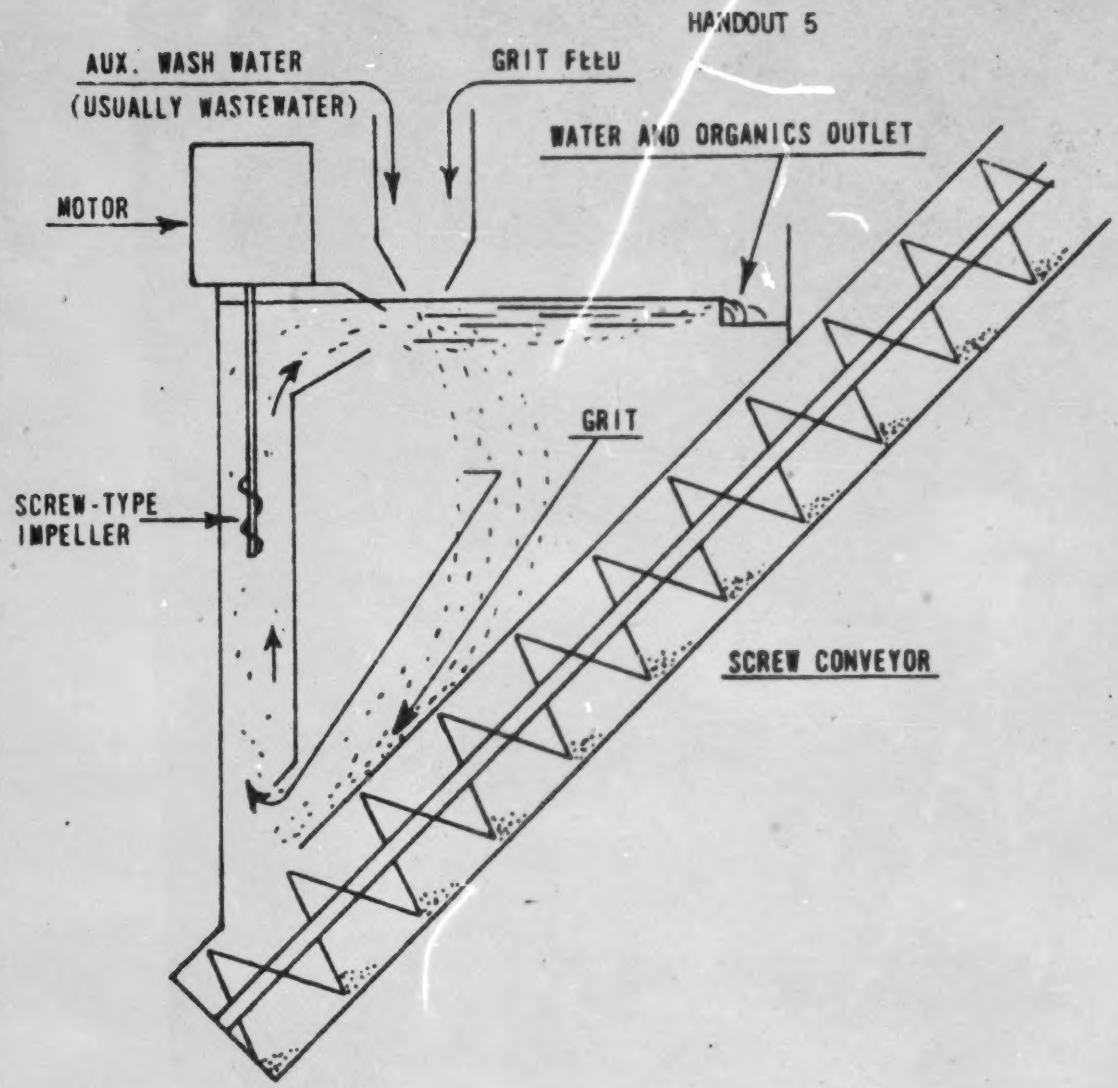
C. Abnormal operation

Excessive grit over weir. Decrease water flow into unit.

Screw pump bound tight. Reverse direction. Flood trough with water.

Odors from unit. Flush and clean unit thoroughly.

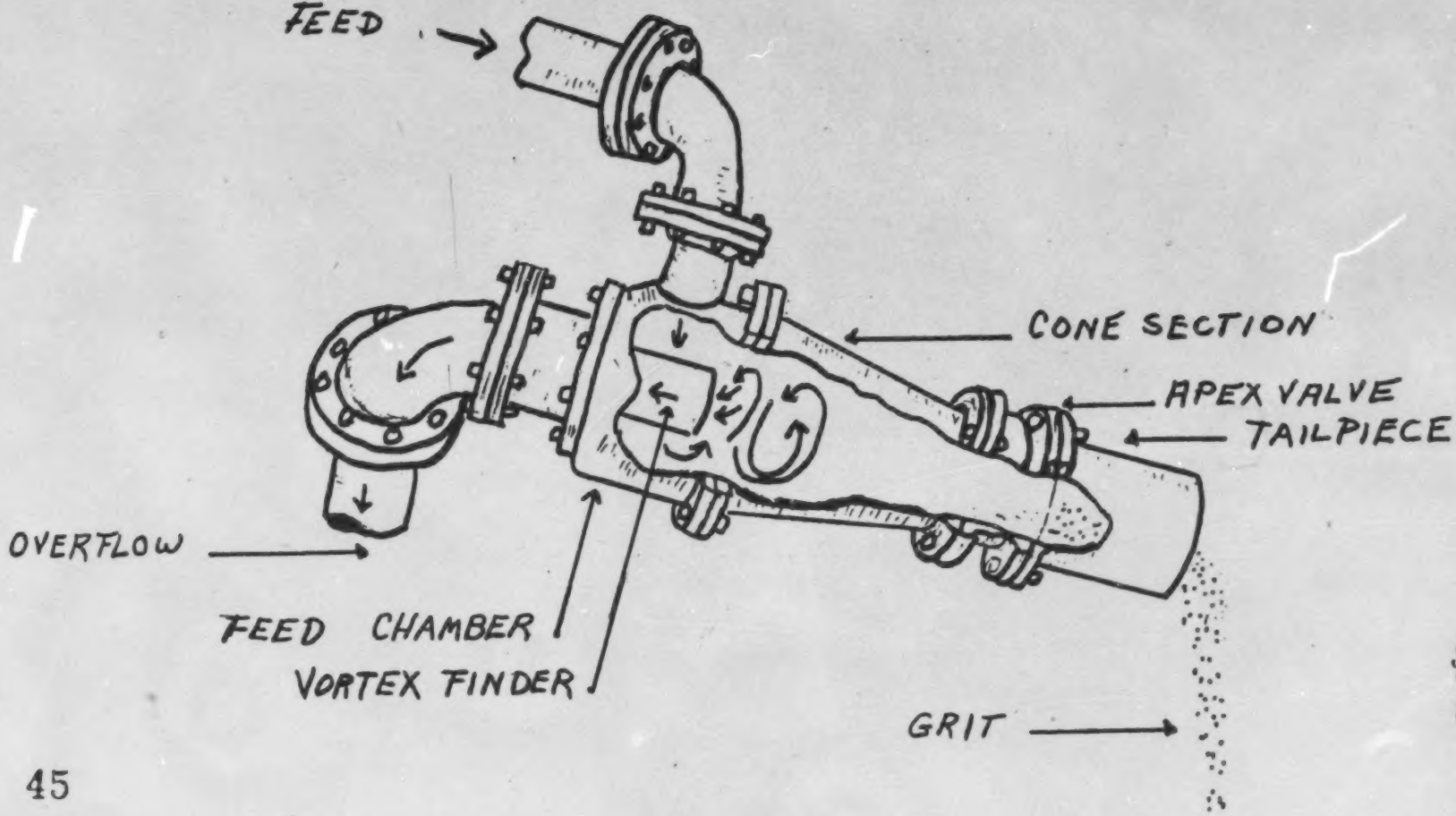
HANDOUT 5



Grit washer

HANDOUT 6

GRIT SEPARATOR CYCLONE



Module No:	Module Title: Preliminary Treatment
	Submodule Title: Grit Removal Dewatering
Approx. Time: 15 minutes	Topic: Safety

Objectives:

The student will be able to:

1. Work safely around screw separators

Instructional Aids:

Instructional Approach:

Lecture
Discussion

References:

Plant O & M Manuals

Class Assignments:

Participate in discussion

Module No:	Topic: Grit Removal - Dewatering

Instructor Notes:	Instructor Outline:
	Safety Keep hands and feet out of unit while in operation. Do not drop large foreign matter into pump trough. To work on unit, tag out and lock switch before starting.

Module No:	Module Title: Preliminary Treatment
	Submodule Title: Grit Removal - Dewatering
Approx. Time: 15 minutes	Topic: Cyclone - Main Parts

Objectives:

The student will be able to:

1. List on a schematic the main parts of the unit.

Instructional Aids:

Handout 7

Instructional Approach:

Lecture
Discussion

References:

Manufacturers brochures
Plant O & M manuals

Class Assignments:

Participate in discussion

Module No:	Topic: Cyclone - Main Parts

Instructor Notes:	Instructor Outiine:
	Cyclone Main parts Grit pump Apex valve Feed chamber Rubber lines Vortex finder Belt drive

Module No:	Module Title: Preliminary Treatment
	Submodule Title: Grit Removal - Dewatering
Approx. Time: ½ hour	Topic: Maintenance

Objectives:

The student will be able to:

1. List proceedures for maintenance of unit

Instructional Aids:

Instructional Approach:

Lecture

References:

Plant Manuals
Manufacturers brochures

Class Assignments:

Participate in discussion

Module No:	Topic: Maintenance
Instructor Notes:	Instructor Outline:

Maintenance

Lock out switch and tag.

Check belt for wear or glazing weekly. Adjust, tighten as needed.

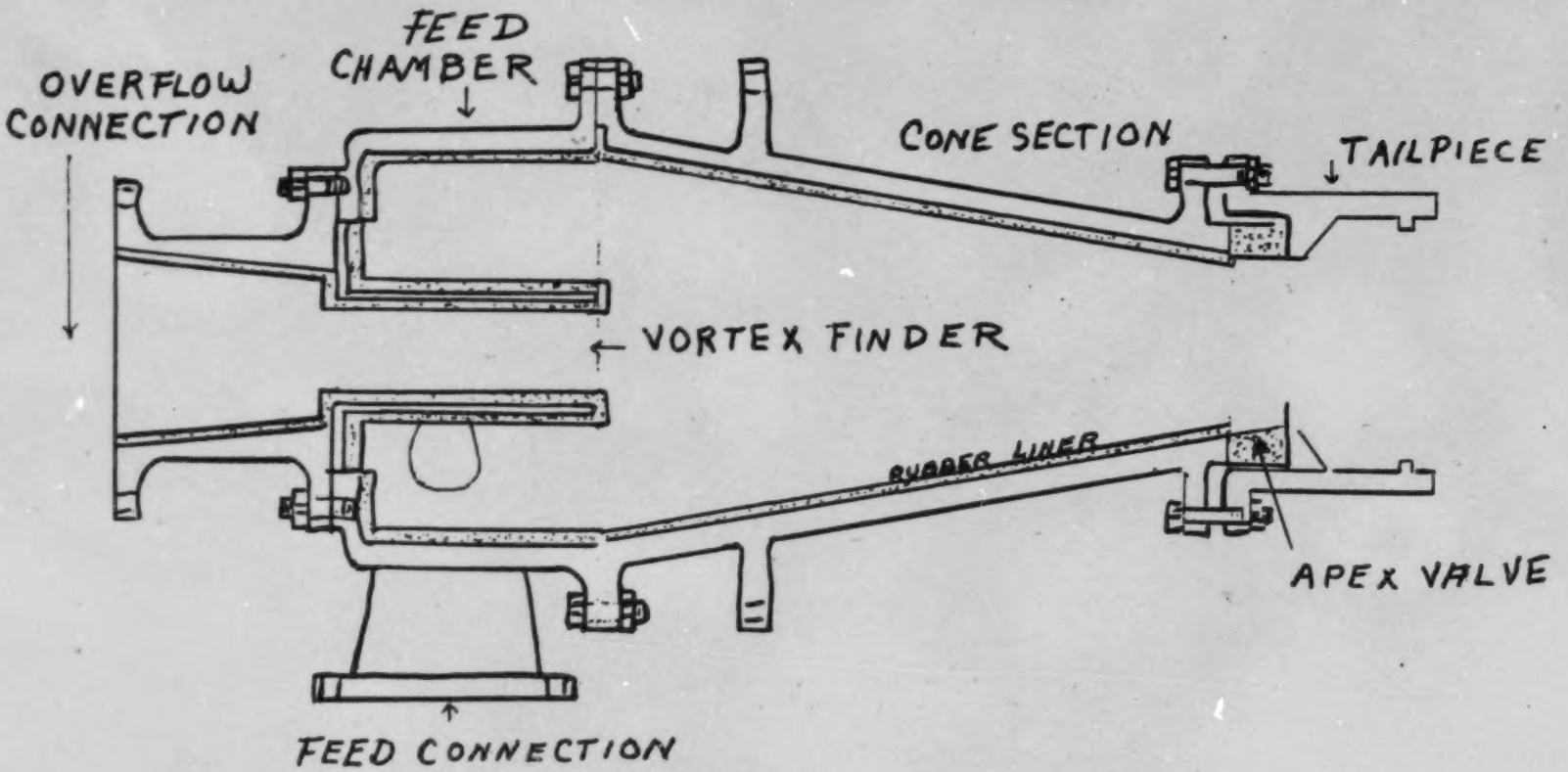
Check for clogging. Close feed valve and liquid line. Remove drain plug. Remove clogs.

Apex valve. Check for wear weekly.

Rubber lining. Replace only if wear is excessive. See manufacturer's handbook. Overhaul yearly.

HANDOUT 7

MAJOR COMPONENTS
CycloNE SEPARATOR UNIT



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Module No:	Module Title: Preliminary Treatment
	Submodule Title: Grit Removal
Approx. Time: ½ hour	Topic: Normal/Abnormal Operation

Objectives:

The student will be able to:

1. Recognize the difference in normal and abnormal operation by labelling a list.

Instructional Aids:

Instructional Approach:

Lecture
Discussion

References:

Plant O & M Manuals

Class Assignments:

Participate in discussion

Module No:	Topic: Normal/Abnormal Operation
Instructor Notes:	Instructor Outline:

Normal Operation

Feed to unit is constant and steady.

Adjust apex valve to allow for largest grit quantity and least organics.

Allow unit to run until all flow from the holding tank is exhausted.

Run unit only if appreciable volume of grit is to be removed.

Abnormal Operation

Excessive organics. Adjust apex valve.

No grit. Adjust apex valve, clean unit.

Excessive noise. Check for wear.

Increasing/decreasing feed pressure will allow for correct grit separation.

Module No:	Module Title: Preliminary Treatment
	Submodule Title: Grit Removal
Approx. Time: 10 minutes	Topic: Safety

Objectives:

The student will be able to:

1. Employ proper safety techniques around this unit.

Instructional Aids:

Instructional Approach:

Lecture
Discussion

References:

Plant O & M Manuals
Manufacturers brochure

Class Assignments:

Participate in discussions

Module No:	Topic: Safety

Instructor Notes:	Instructor Outline:
	Safety Belts. Handout of unit. Noise may require ear protection.

SUMMARY

Module No:	Module Title: Preliminary Treatment
	Submodule Title: Screening/Comminution
Approx. Time: 7 hours	Topic:

Overall Objectives:

Upon completion of this module the participant will be able to:

1. Describe the various methods used to screen and comminute wastewater, identify equipment used, and relate the importance of this procedure.
2. Describe the process of
   a. Screening
   b. Comminution
3. Identify equipment used in
   a. Screening
   b. Comminution

Instructional Aids:

Handouts
Overheads

Instructional Approach:

Lecture
Discussion

References:

1. Operation of Wastewater Treatment Plants, Sacramento
2. WPCF MOP #11
3. Wastewater Engineering, Metcalf and Eddy
4. Various Equipment Manufacturer's Material
5. Aeration in Wastewater Treatment Plants, WPCF MOP #5

Class Assignments:

Read handouts
Prepare handouts
Participation discussions

Module No:	Module Title: Preliminary Treatment
	Submodule Title: Screening/Comminution
Approx. Time: 15 minutes	Topic: Introduction

Objectives:

Upon completion of this module the participant will be able to:

1. Describe the purpose of screening and comminution.

Instructional Aids:

None

Instructional Approach:

Lecture

References:

1. WPCF MOP #11
2. Wastewater Engineering
3. Operation of Wastewater Treatment Plants, Sacramento

Class Assignments:

Participate in discussion

Module No:	Topic: Screening/Comminution

Instructor Notes:	Instructor Outline:
I. 1. To remove the larger materials that may cause extensive damage or necessitate repair to equipment. This may also mean in the case of comminution, the reduction in size of larger suspended matter, e.g. cloth, fibers, garbage, fecal matter. Heavy inorganics are removed - metal objects.	I. Introduction a. Purpose

Module No:	Module Title: Preliminary Treatment
	Submodule Title: Screening/comminution
Approx. Time: 1 hour	Topic: Equipment

Objectives:

Upon completion of this module the participant will be able to:

1. List equipment used to screen or comminute wastewater.
2. List clear openings of screen equipment.

Instructional Aids:

Handout 1

Instructional Approach:

Lecture
Discussion

References:

1. WPCF MOP #11
2. Operation of Wastewater Treatment Plants, Sacramento

Class Assignments:

Module No:	Topic: Equipment

Instructor Notes:	Instructor Outline:
II. 1. 3/4" - 6" clear openings vertically or angularly placed in flow of wastewater. A. Manually cleaned daily. B. Cleaned by a timer, a flow differential control removal rates are at an average 0.7% of solids. Manually cleaned units average openings for coarse bar - 2". Fine bar - 3/4". Mechanically cleaned coarse bar - 3". Fine bar - 3/4". Coarse bars trap logs, timbers, stumps etc. Usually are found in larger flow plants with combined sewer systems.	II. Equipment (Handout) 1. Bar racks A. Manually cleaned B. Mechanically cleaned 2. Comminuters A. Comminuters B. Grinders C. Barminuter 3. Screening devices A. Fine

Module No:	Topic: Screening/Communition

Instructor Notes:	Instructor Outline:
Handout of Link Belt unit #2	II. 1. a. Maintenance of mechanically cleaned unit A. Lubricate foot shaft weekly B. Lubricate wiper rollers frequently to mainta free movement. C. Shear pin on upper sprocket drive to be replaced if broken. This device protects unit from major breakdowns. D. Lubricate upper chain and drive unit weekly.

Handout 1

SCREENING EQUIPMENT

BAR RACKS

- mechanically cleaned
- manually cleaned

COMMINUTERS

- grinders
- barminuters

FINE SCREENS

Handout 2

LINK-BELT

THRU-CLEAN BAR SCREEN

Service Instructions

This manual contains complete instructions for the installation, operation and service of Link-Belt Thru-Clean bar screens. The life and economical operation of the machine is dependent, to a great extent, on the care taken during installation and the subsequent lubrication and service.

PREPARATION OF SITE

Before installing screen in channel, check channel width, depth, etc., against the dimensions on Link-Belt general arrangement drawing. Make sure that the foundation bolts for locating foot shaft, screen bars, chain guides, bar spacer, screen housing and all other components are located in the channel walls and floor in accordance with dimensions shown on general arrangement drawing.

INSTALLATION

Foot shaft

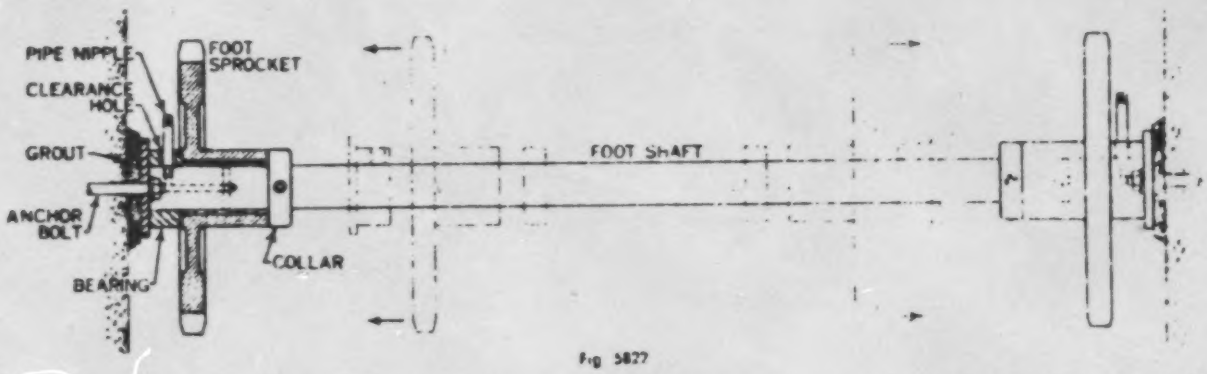


Fig 5827

1. Placing safety collars on shaft and slide them in toward center of shaft.
2. Mount sprockets, one on each end of shaft with long hubs in toward safety collars. Be sure that sprockets rotate freely on shaft.
3. Mount one bearing on each end of the shaft with hubs toward sprockets.
4. Move all parts back far enough from the shaft ends to clear anchor bolts in channel wall.
5. Lower shaft into channel, making sure that the tapped

holes in each end of shaft and clearance hole in bearing hub are in an upward position.

6. Slide bearings out to ends of shaft and over anchor bolts in channel wall after shaft is in position.
7. Put the two pipe nipples used for lubrication system through the clearance holes in the bearings and into threaded holes in foot shaft.

Foot sprockets

1. Place foot sprockets on their proper centers, as shown on foundation and general arrangement drawings, and center in the channel.
2. Fasten safety collars to keep sprockets in position.
3. Move bearings toward sprockets so that sprockets will rotate freely with a minimum amount of clearance.
4. Force bearing setscrews tight against shaft.
5. On anchor bolts nearest wall, turn nuts finger-tight against bearings. Tighten nuts on other side of bearings, making sure that shaft is centered in channel, level with and at right angles to channel wall.

Foot shaft assembly is now ready for grouting.

Bar rack

Bar rack is next assembled in the channel. The bar rack will be in one piece or in sections depending on width of screen. Wooden block spacers are banded between the rack bars to protect and support them during shipment and assembly. Remove these blocks after rakes are attached to the chains.

1. Place bar rack on anchor bolts located in the channel floor. Be sure that bar rack is lined up vertically, and center it with sprockets on foot shaft.
2. Check the distance between foot sprockets and bar rack assembly using general arrangement drawing.
3. Secure bar rack in place using anchor bolts; grout if necessary.

Side plates

1. Locate and space two side plates in position against the channel walls, one on each side, using dimensions shown on general arrangement drawing.
2. Secure plates in position, grout to suit.

Slack chain supports

Bolt slack chain supports to channel wall under sprockets. Maintain ¾" from outside diameter of sprockets to support surface.

Chain guides

Bolt chain guides to channel walls, maintaining 5-11/16" from centerline of head and foot shaft. The ends should clear the sprockets by ½".

Bar rack spacer

1. Place spacer supports on anchor bolts.
2. Bolt spacer assembly to supports.
3. Adjust spacer so that it is parallel with foot shaft in both directions. Spacer must also be centered so that spacer teeth are centrally located between bars in bar rack. Spacer must pivot freely so that it will always return to correct position.
4. Grout behind spacer supports as required.
5. Attach lubrication tubing for the foot shaft bearings to channel walls.

Head section

1. Bolt head section housing panels together and set them in position over channel opening.
2. Temporarily bolt head section housing tight to foundation.
3. Check clearance with center plate as shown on general arrangement drawing.

Deflector plate must pivot freely so that it will always return to its proper position.

Head shaft

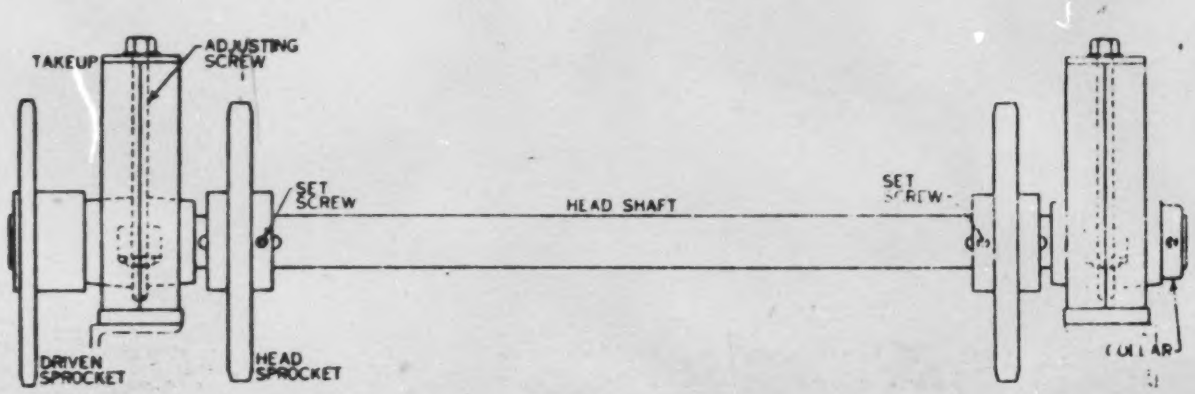


Fig 5823

1. Assemble sprockets, takeups and safety collars on head shaft.
2. Bolt head shaft in position, and line it up with foot shaft. Head shaft should be parallel to the foot shaft in both planes. Alignment is obtained by shifting head shaft housing and head shaft bearings.
3. Line up head sprockets with the foot sprockets.

Chains

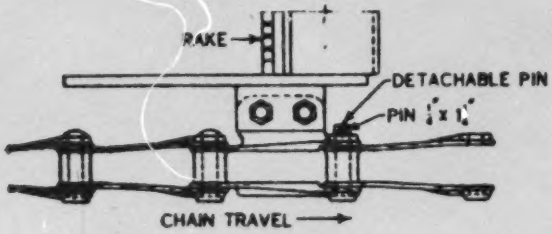


Fig 5824

1. Assemble rake carrying chains around head and foot sprockets with rake attachments and chain assemblies as shown on general arrangement drawing.
2. Attach rakes as shown on general arrangement drawing.
3. Tighten chains by moving the takeup bearing adjusting screws. Rotate both screws the same number of turns so the head shaft remains parallel to the foot shaft. When chains are pulled taut, back off on the adjusting screws to provide a small amount of slack.
4. Secure takeup screws with locknuts. Mount drive sprockets and drive machinery on head section housing. After machinery is properly aligned install wiper blade in wiper guides.

OPERATION

If current is available for the drive motor, jog screen through one complete cycle to be sure all parts clear. Check bar spacer and deflector plate to see that they return to proper positions after rakes have passed. Check and adjust wiper so that it rolls free in the guides.

Operate screen through several cycles. If all parts function properly, and a shredder is included with the installation, install it in accordance with instructions attached to it, and bolt trough, chutes, etc., in position.

If permanent current is available, connect motor so that screen can be operated for a short time. If a fluid drive is used, connect the motor for the higher voltage and operate it on the lower voltage. This is done for torque control reasons.

Lubricate all parts and then operate screen for a short run-in period. During the run-in period, recheck all parts to make sure they function correctly.

Pay particular attention to the operation of the rolling wiper. Check the horizontal end-play, if it appears excessive, add more washers to the flange side of the rollers.

If, during operation, the rake chains move away from the wiper, allowing the wiper to fall free for a distance after it leaves the rake, take up on the rake chains and move the chain guides closer to the back of the chains.

The screen can be operated manually or by the use of a timer.

If an automatic timer is used to control the operation of the screen, set it to operate the screen at intervals sufficiently long and properly spaced to suit local conditions. The screen should operate often enough to keep the screen bars reasonably free of screenings, etc. The minimum recommended operating cycle is 10 minutes' operation every 2 hours.

See attached instruction sheets for setting and maintaining the timer.

LUBRICATION AND MAINTENANCE

Lubricate the foot shaft at least once a week and more often if sand in sewage is excessive.

Lubricate the pivoted spacer and deflector plate as often as necessary to keep them pivoting freely. Lubricate wiper rollers as often as required to keep them rolling freely in the guides.

All gear drives, shredders and chain drives must be lubricated in accordance with instructions attached to them.

Thru-Clean bar screens can be equipped with shear pin hubs for overload protection. If a pin breaks, replace it by removing the chain guard, taking out the broken pieces of pin, realigning the holes and inserting a new pin. Shear pin breakage can usually be traced to some foreign object jammed in the screen or screen mechanism. Be sure the cause of jamming is corrected before installing a new pin and again operating screen.

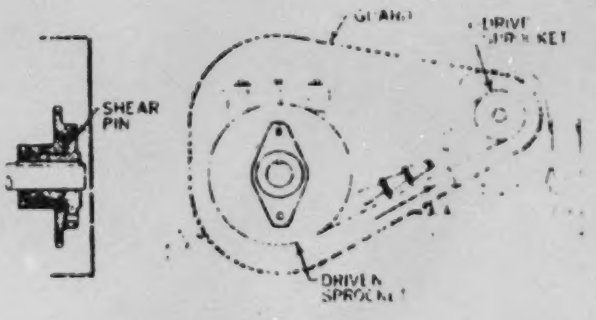


Fig 5825

Link-Belt Thru-Clean Bar Screen

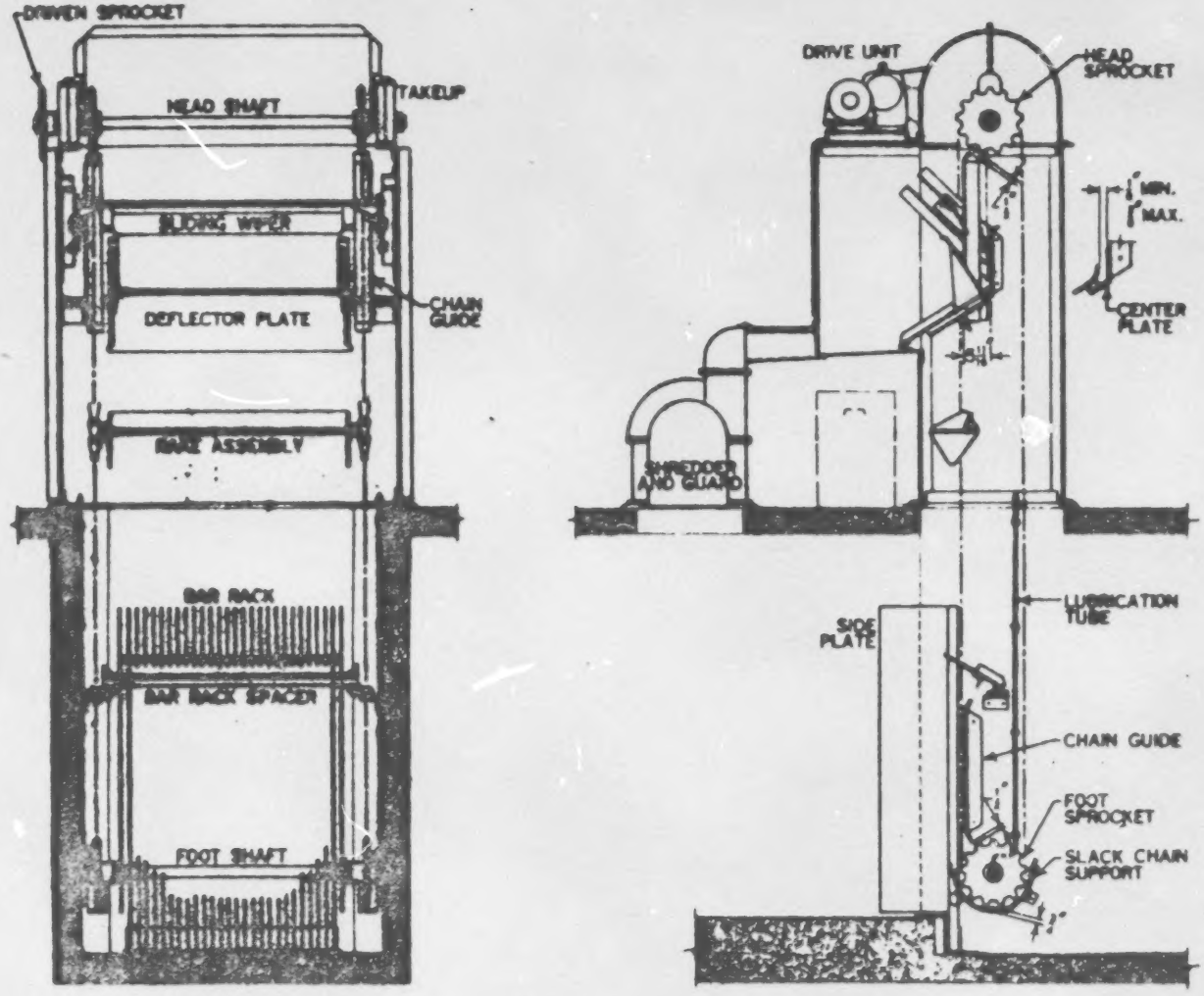
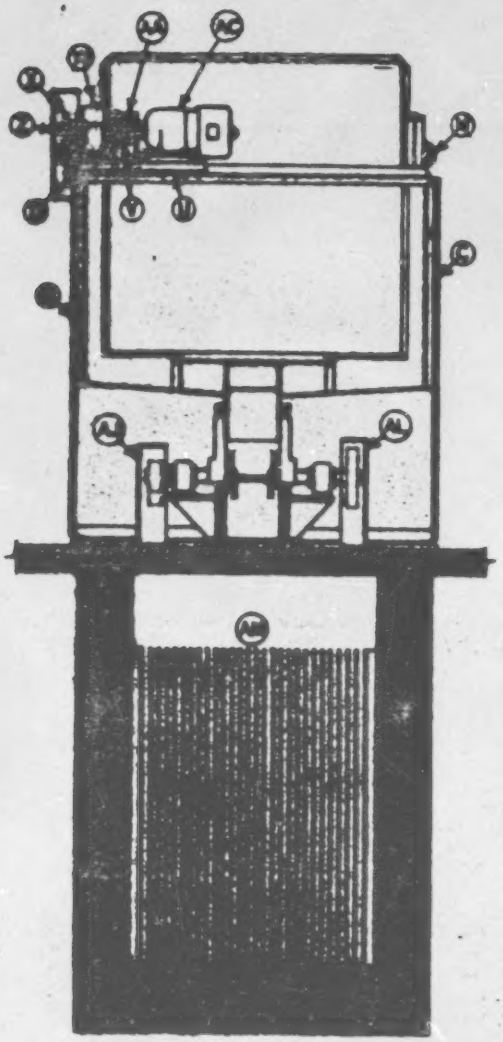


Fig. 9827

Link-Belt Thru-Clean Bar Screen Parts



FRONT VIEW

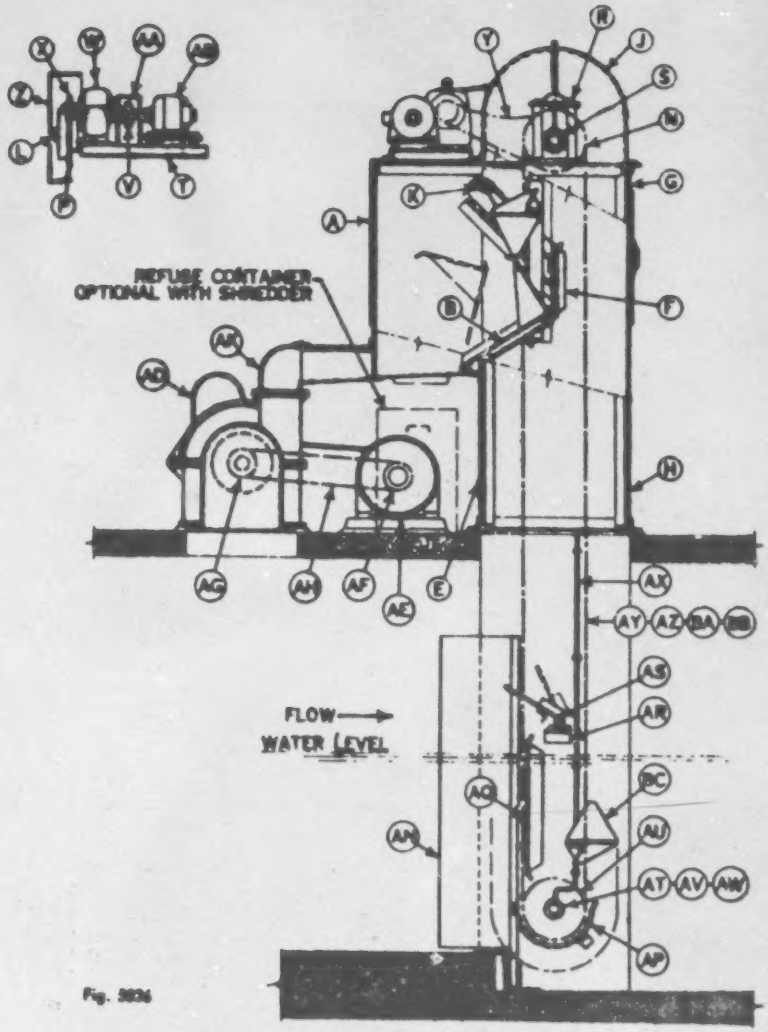


Fig. 3826

SIDE VIEW

Symbol	Quantity	Name	Symbol	Quantity	Name	Symbol	Quantity	Name
A	1	Front housing	T	1	Baseplate	AL	1	Flywheel guard
B	1	Deflector plate	U	1	Baseplate	AM	1	Bar rack
C	1	Side panel	V	1	Flexible coupling	AN	2	Side plate
D	1	Side panel	W	1	Worm gear reducer	AP	2	Slack chain support
E	1	Front panel	X	1	Driven sprocket	AQ	2	Chain guide
F	1	Center plate	Y	1	Drive chain	AR	2	Spacer support
G	1	Upper back plate	Z	1	Chain guard	AS	1	Spacer assembly
H	1	Lower back plate	AA	1	Coupling guard	AT	1	Foot shaft
J	1	Hood	AB	1	Motor	AU	2	Foot sprocket
K	1	Wiper	AC	1	Electrohoist drive	AV	2	Bearing
L	1	Hood shaft	AD	1	Shredder	AW	2	Collar
M	1	Hood shaft	AE	1	Motor	AX	2	Lubrication tube & fittings
N	2	Main sprocket	AF	1	Driver sheave	AY	1	Chain 730 RH
P	1	Driven sprocket	AG	1	Driven sheave	AZ	1	Chain 720 LH
Q	1	Driven sprocket	AH	1 Set	V-belt	BA	2	Detachable pin 720 chain
R	2	Takeup	AJ	1	V-belt guard	BB	2	Pin ⅛" x 1⅛" brass
S	1	Collar	AK	1	Discharge chute	BC		Rake

Module No:	Module Title: Preliminary Treatment
	Submodule Title: Screening/Comminution
Approx. Time: 1½ hours	Topic: Comminution Maintenance

Objectives:

Upon completion of this module the participant will be able to:

1. Label parts of a comminuter.
2. List startup and shut down procedures.
3. List preventive maintenance procedures.

Instructional Aids:

Handout #3

Instructional Approach:

Lecture
Discussion

References:

1. WPCF MOP #11
2. Operation of Wastewater Treatment Plants, Sacramento

Class Assignments:

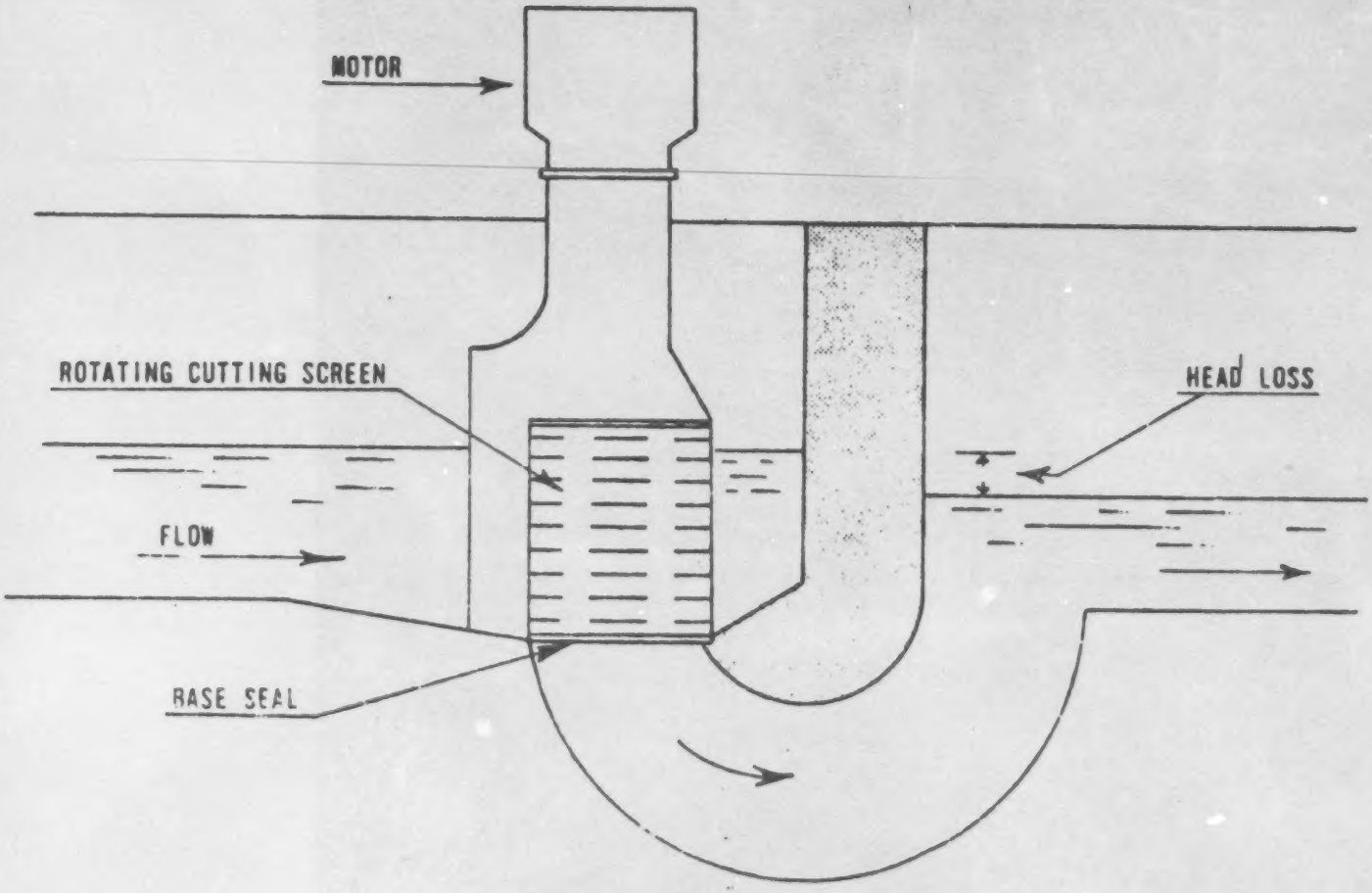
Participate in class discussion

Module No:	Topic: Screening/Comminution

Instructor Notes:	Instructor Outline:
2. Comminuters A. Comminuters 1. Flow through 2. In channel Reduce size of offending materials by allowing the flow to pass through a settled screen and the trapped materials to be cut into smaller pumpable sizes. a. Handout parts b. Shaft wear caused at packing (bearings) and alighment settings connects motor to drum. c. Bearing requires lubrication as it rotates shaft from stress and allows drum to rotate in alighment. d. Drum rotates on shaft. Contains cutter blades and teeth. e. Cutters, shredders and combs located on drum and base. Fixed combs trap material to be cut and as drum rotates the cutters and shredders are brought in contact	II. 2. A. Parts of a comminutor a. Motor b. Shaft c. Bearing d. Drum e. Cutters, shredders and combs f. Base

Module No:	Topic: Screening/Comminution

Instructor Notes:	Instructor Outline:
with the combs and the reduction of material takes place. f. Base supports the weight and is bolted to the concrete channel.	II. 2. B. Start up and shut down 1. Once unit is started it is only shut down for repair or preventive maintenance. 2. Clear unit of major obstructions. 3. Turn on power 4. Shut down procedure in reverse 2. C. Preventive maintenance 1. Visually check drum 3 x's daily 2. Remove major obstructions. 3. Cutter mechanisms have a life of 5 years. Replace following manufacturer's recommendations.



Handout 3

Page 70

Terminator

Module No:	Module Title: Preliminary Treatment
	Submodule Title: Screening/Comminution
Approx. Time: ½ hour	Topic: Safety

Objectives:

Upon completion of this module, the participant will be able to:

1. Demonstrate safe procedures arount the comminuter.

Instructional Aids:

None

Instructional Approach:

Lecture

References:

1. WPCF MOP #11
2. Operation of Wastewater Treatment Plants, Sacramento

Class Assignments:

Participate in discussion

Module No:	Topic: Safety

Instructor Notes:	Instructor Outline:
Students with this unit are to add to the safety steps. This will encourage class discussion.	II. 2. A. Safety 1. Do not put hand into flow while unit is operating. 2. Do not repair unit until it is totally isolated electrically and drained of water.

Module No:	Module Title: Preliminary Treatment
	Submodule Title: Screening/Comminution
Approx. Time: 45 minutes	Topic: Grinders

Objectives:

Upon completion of this module the participant will be able to:

1. Identify the difference between a comminuter and a grinder.

Instructional Aids:

Refer to handout 2, page 5 & 6

Instructional Approach:

Lecture
Discussion

References:

1. Manufacturer's Guide
2. WPCF MOP #11

Class Assignments:

Participate in discussion
Read handout

Module No:	Topic: Grinders

Instructor Notes:	Instructor Outline:
2. A grinder is out of flow and a comminuter is in flow.	II. 2. B. Grinders Located out of flow only with screenings collected and passed through the unit and ground screenings returned to the flo High speed as opposed to the slower speed of comminuters. Infrequent operation. Parts Motor Rotating drum Cutters N.B. This is a high speed unit. Care must be taken in safety in feeding of screens material.

Module No:	Module Title: Preliminary Treatment
	Submodule Title: Screening/comminution
Approx. Time: ½ hour	Topic: Start up/Shut down

Objectives:

Upon completion of this module the participant will be able to:

1. Demonstrate the proper start up and shut down of the grinder.

Instructional Aids:

Running grinder at an installation
Handout 2

Instructional Approach:

Lecture
Demonstration

References:

1. WPCF MOP #11
2. Manufacturer's Guide

Class Assignments:

Read handout
Participate in discussion
Demonstrate grinder operation

Module No:	Topic: Start up/Shut down

Instructor Notes:	Instructor Outline:
	II. B. Start up and shut down 1. Turn switch on and allow motor to come to full operating speed. 2. Unit may require outside source of wate turn on as you start unit (kitchen grinder). 3. Feed screenings to unit in piecemeal fashion to allow for proper grinding. Do not jam or overfill. Do not put metal or plastic into unit. 4. Stop unit by switch. 5. After complete stop let water flush uni for a few minutes before closing valve.

Module No:	Module Title: Preliminary Treatment
	Submodule Title: Screening/comminution
Approx. Time: ½ hour	Topic: Grinder Maintenance

Objectives:

Upon completion of this module the participant will be able to:

1. List procedures for maintaining unit.

Instructional Aids:

Handout 4

Instructional Approach:

Lecture
Discussion

References:

1. Manufacturer's Guide
2. Plant O & M Manuals

Class Assignments:

Participate in discussion
Fillout handout

Module No:	Topic: Grinder Maintenance

Instructor Notes:	Instructor Outline:
	II. D. Maintenance and preventive maintenance 1. Grease bearings weekly. 2. Check water flow into unit weekly. 3. Clean out grinder after each operation. 4. Cutter blades replace as per manufacturer's suggestions.

Handout 4

Grinder Maintenance

1.

2.

3.

4.

Module No:	Module Title: Preliminary Treatment
	Submodule Title: Screening/comminution
Approx. Time: 45 minutes	Topic: Barminuter

Objectives:

Upon completion of this module the participant will be able to:

1. Label parts on a drawing.

Instructional Aids:

Handout 5

Instructional Approach:

Lecture
Discussion

References:

1. Operation of Wastewater Treatment Plants, Sacramento.
2. Manufacturer's Guide

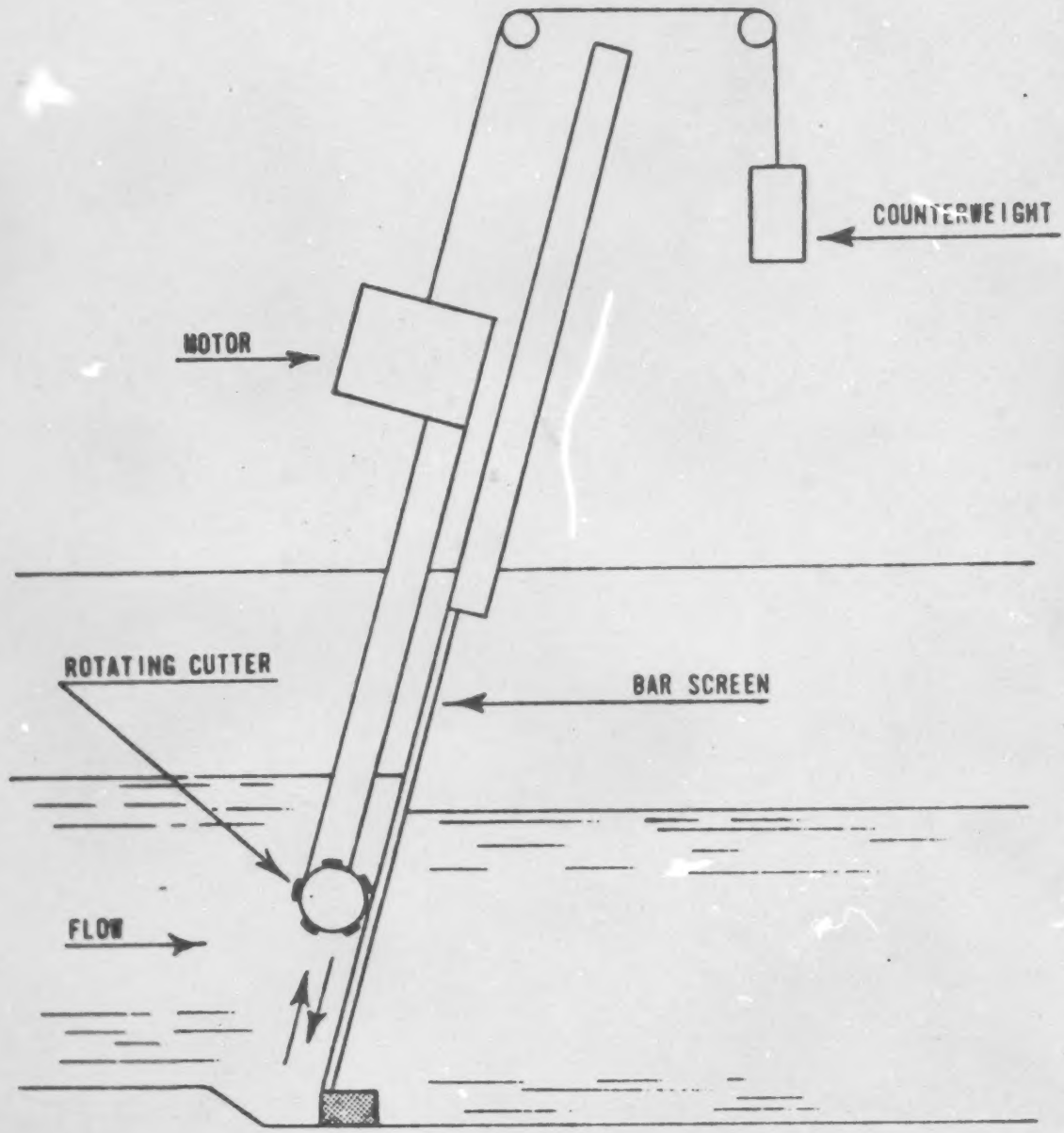
Class Assignments:

Participate in class discussion
Label handout

Module No:	Topic: Barminuter

Instructor Notes:	Instructor Outline:
II. 2. C. Placed in stream flow 1. Counter weight offsets the heavy motor and unit weight allowing free travel of unit. 2. Motor "rides" on the entire system and is located on front up-stream side of the unit. 3. Cutting assembly rotating drum with blade the shred entrapped material on the screen. 4. Screen performs function of both a fine screen and cutting surface for the cutting drum.	II. 2. C. Barminuter Trade mark of Chicago Pump Parts 1. Counter weights 2. Motor 3. Cutting assemble 4. Screen

Handout 5



Barminutor

Module No:	Module Title: Preliminary Treatment
	Submodule Title: Screening/comminution
Approx. Time: 45 minutes	Topic: Barminuter - Start up/Shut down Maintenance - Abnormal Operation

Objectives:

Upon completion of this module the participant will be able to:

1. Identify preventive maintenance procedures.
2. List possible problems of abnormal operation.

Instructional Aids:

None

Instructional Approach:

Lecture
Discussion

References:

1. Operating Wastewater Treatment Plants, Sacramento.
2. Manufacturer's Guide

Class Assignments:

Participate in discussion

Module No:	Topic: Barminuter - Start up/Shut down Maintenance - Abnormal Operation
Instructor Notes:	Instructor Outline:
II. 2. C. 1. Material blocked screen cause head difference, caust activation of the unit.	Start up and shut down 1. Timed or "dam buildup" accuated. 2. Automatically turns on and off. Equipped with a manual override. Preventive maintenance 1. Check oil levels. 2. Add grease to unit as specified by manufacturer 3. Check 3 x's daily to prevent damage. Remove major blockages immediately. Abnormal routine 1. Will not start, reset switch on power supply is defective. 2. Reverses too frequently on mid cycle; blockage screen, misalignment of cutters, plugged revers spring.

Module No:	Module Title: Preliminary Treatment
	Submodule Title: Screening/Communition
Approx. Time: 20 Min.	Topic: Safety

Objectives:

Upon completion of this module the participant will be able to:

1. Perform safely around this unit.

Instructional Aids:

None

Instructional Approach:

Lecture
Discussion

References:

1. Operation of Wastewater Treatment Plants, Sacramento
2. Manufacturer's Guide

Class Assignments:

Participate in discussion

Module No:	Topic: Safety
Instructor Notes:	Instructor Outline:

II. 2. C. Safety

1. Do not drop objects into unit.
2. Encase of jam, shut unit off completely.
3. On this unit do not work alone. Parts are too heavy for one person to handle.
4. If located in deep channel, wear harness.

Module No:	Module Title: Preliminary Treatment
	Submodule Title: Screening/Comminution
Approx. Time: 1½ hours	Topic: Fine Screens

Objectives:

Upon completion of this module the participant will be able to:

1. Describe written operation of the unit discussed.
2. List parts of unit.
3. List maintenance procedures.

Instructional Aids:

Handout 6 & 7

Instructional Approach:

Lecture
Discussion

References:

1. WPCF MOP #11
2. Suspended Solids Removal, USEPA

Class Assignments:

Module No:	Topic: Fine Screens

Instructor Notes:	Instructor Outline:
III. Mechanically cleaned by waterjet nozzles. Perforated bronze, stainless steel plate or drum. Removes smaller particles. Size of openings are usually less than 3/16 " Handout	III Fine Screens 1. Operation Screen travels into the water flow, submerge on the downstream side and leaves flow on upstream side. Trapped solids are settled off by means of a spray nozzle. Not a practical device for wastewater as they get clogged easily and require extensive cleanin Better application is the effluent polish to remove minute particles. Excellent results are obtained in water treatment plants 2. Parts List a. Drum b. Screen material c. Chain sprocket d. Chain e. Reducer f. Motor g. Jet spray assembly 3. Maintenance a. Grease drum bearing weekly. b. Replace screen material if torn or punctured. c. Grease upper sprocket monthly. d. Check for worn links and replace monthly e. Grease reducer bearing weekly. f. Check motor for wear (bearings).

Module No:	Topic: Fine Screens

Instructor Notes:	Instructor Outline:

g. Clean nozzles as needed

4. Normal operation

a. Turn on drum. Drive unit to run continuously in flow

b. Check for problems

c. Open channel gate

d. Flow to be constant so as to submerge 1/3 of drum.

e. Water spray can now be turned on to wash off screen.

f. Check unit thoroughly every hour to prevent damming or blinding of unit.

5. Abnormal operation

a. Blinding - water pressure too low in nozzles.

b. Unit vibrates noisily - excessive water flow in channel

6. Safety

a. Tag and lock out unit

b. Do not allow large objects to hit screen

c. Do not walk on screen.

d. Work with two people. Minimum due to bulky parts. Awkward to handle.

Handout 6

FINE SCREENS

Operation

Parts

1.

2.

3.

4.

5.

6.

7.

Maintenance

1.

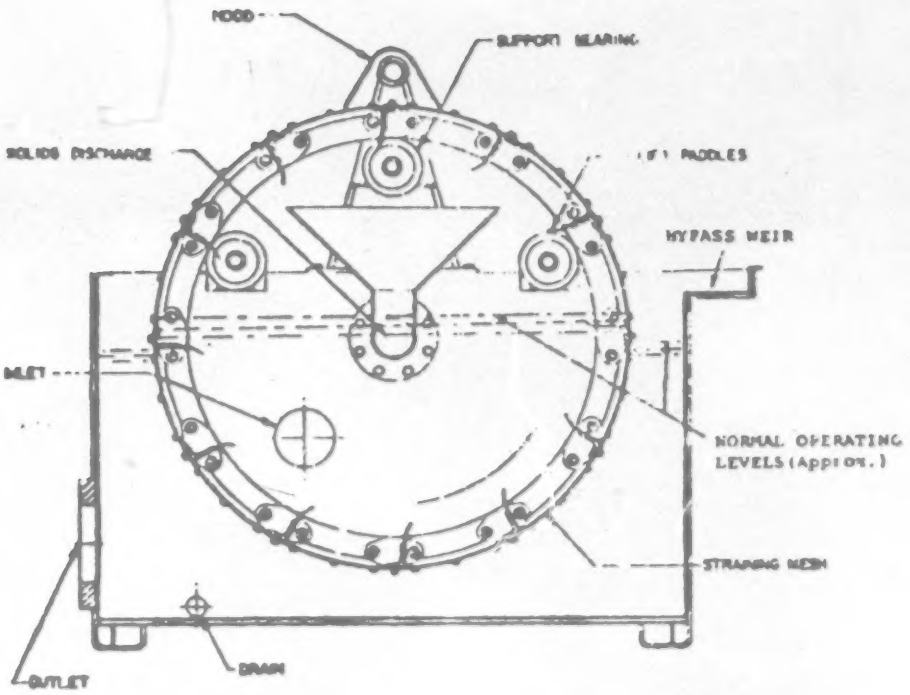
2.

3.

4.

5.

6.



TYPICAL MICROSCREEN UNIT, CROSS SECTION

Module No:	Module Title: Preliminary Treatment
	Submodule Title: Preaeration
Approx. Time: 1 hour	Topic:

Objectives:

Upon completion of this module the participant will be able to:

1. Identify preaeration equipment.
2. Label schematic of process equipment.
3. List corrective action for abnormal operation.

Instructional Aids:

Handouts
Overheads

Instructional Approach:

Lecture
Discussion

References:

1. WPCF MOP #8
2. Wastewater Engineering, Metcalf and Eddy.
3. Manufacturer's Guide

Class Assignments:

Read handouts
Participate in discussions

Module No:	Module Title: Preliminary Treatment
	Submodule Title: Preaeration
Approx. Time: 1 hour	Topic: Introduction

Objectives:

Upon completion of this module the participant will be able to:

1. Identify
   a. Diffused
   b. Mechanical
2. List operations parameters processes.

Instructional Aids:

Handout 1

Instructional Approach:

Lecture
Discussion

References:

1. WPCF MOP #11
2. Operation of Wastewater Treatment Plants
3. WPCF MOP #8

Class Assignments:

Read handout
Participate in discussion

Module No:	Topic: Preaeration

Instructor Notes:	Instructor Outline:
Freshen sewage Control odors Improve settling Improves grease removal Grit removal Uniform distribution of suspended and floating solids Increase BOD removals	I. Introduction 1. Diffused 2. Mechanical
Handout I 1. Compressed air or air from a blower pump are used to disperse air to the unit. The air discharge point is through a sparger similar to the fish tank bubbler systems.	
Handout 2 2. Massive surface and/or draft tube mixers are used to aerate liquid. DO measurement needed to measure freshness of wastewater.	A. Operation parameters 1. Retention time 10 - 45 min. 2. Tank depth - 15 ft. 3. Air requirements 0.1 - 0.4 cu. ft./gal. of wastewater 4. Minimal deposition of solids is allowed 5. DO measured by using DO meter.

Module No:	Topic: Preaeration
Instructor Notes:	Instructor Outline:

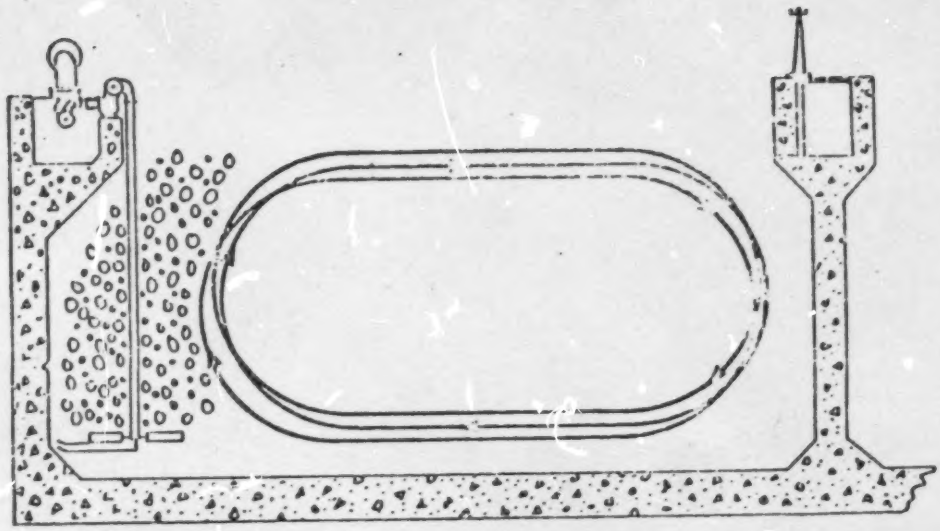
B. Main parts

1. Diffuser
2. Blower

C. Safety

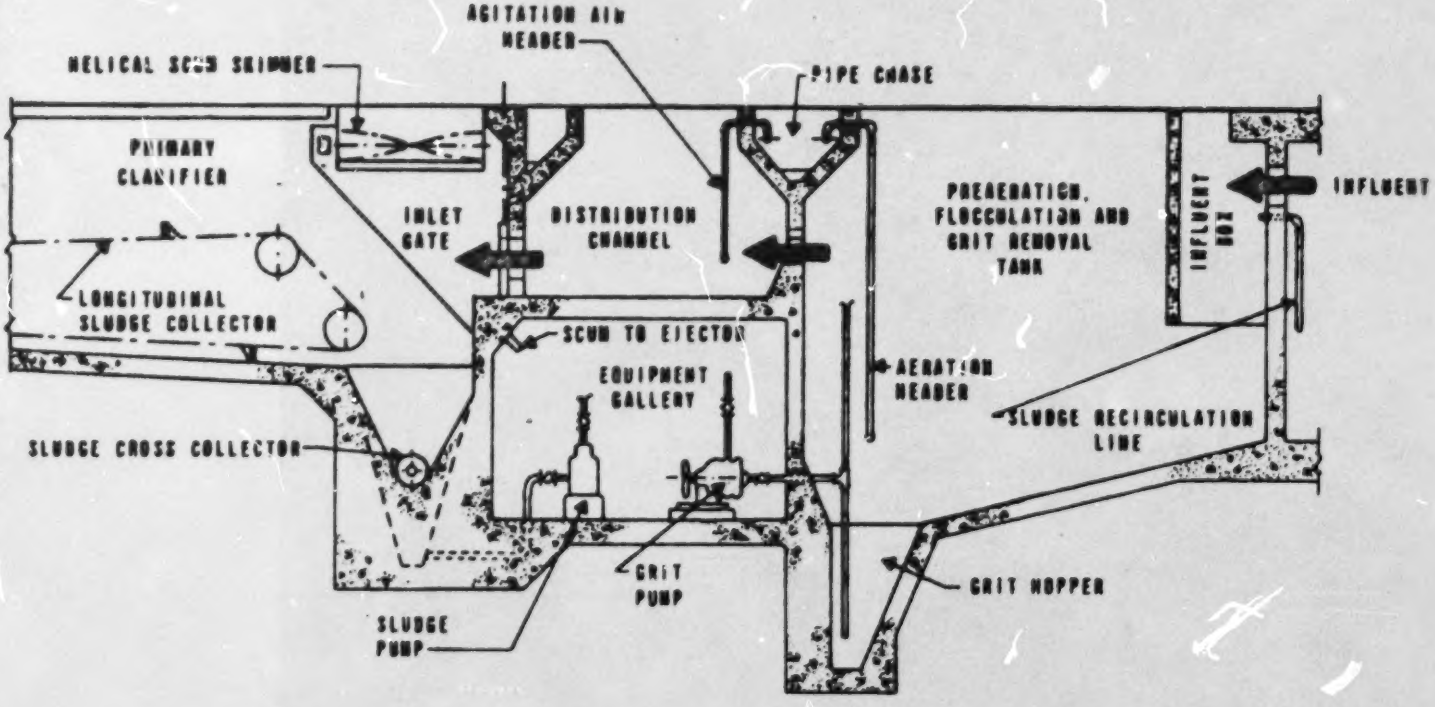
1. Railing around the unit to be secure.
2. Do not work on unit unless unit is drained.
3. Keep area free of grease, wastewater, oil to pipcant clips and balls.

Handout 1



CIRCULATION PATTERN OF
AERATION TANK

PRIMARY TREATMENT UNITS



Module No:	Module Title: Preliminary Treatment
	Submodule Title: Flotation/Grease Separation
Approx. Time: 3 hours	Topic:

Objectives:

Upon completion of this module the participant will be able to:

1. Identify need and purpose for flotation.
2. Identify types of flotation units.
3. Outline steps of operation of flotation units.
4. List 2 advantages/disadvantages of flotation.

Instructional Aids:

Handouts
Overheads

Instructional Approach:

Lecture
Discussion

References:

1. WPCF MOP #8
2. Manufacturer's Guide
3. Plant O & M Manuals

Class Assignments:

Read handouts
Participate in discussion

Module No:	Module Title: Preliminary Treatment
	Submodule Title: Flotation/Grease Separation
Approx. Time: 1 hour	Topic: Purpose and Types

Objectives:

Upon completion of this module the participant will be able to:

1. Identify the need and purpose of flotation.
2. List types of flotation units.

Instructional Aids:

Handouts 1, 2 & 3

Instructional Approach:

Lecture
Discussion

References:

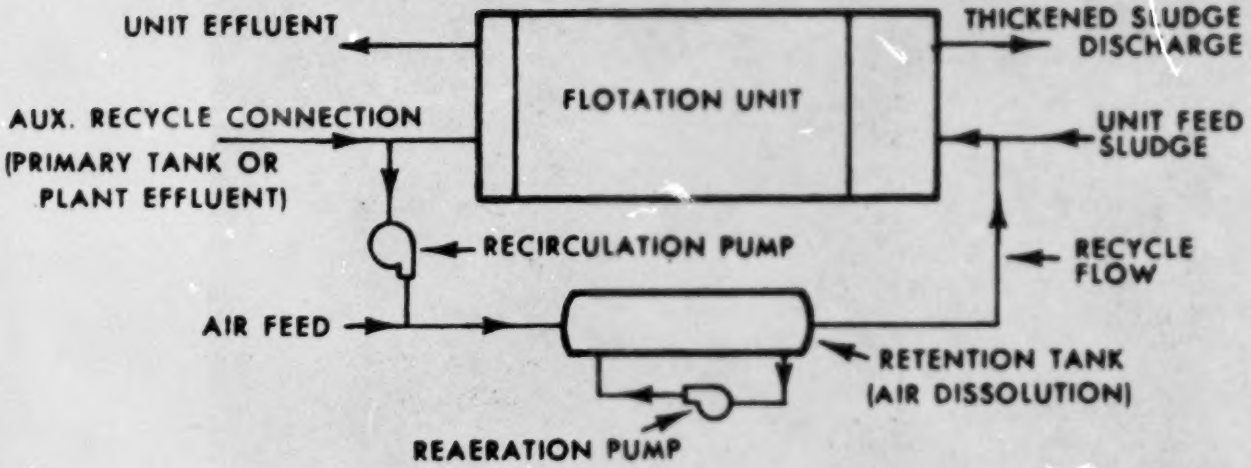
1. WPCF MOP #8
2. Manufacturer's Guide

Class Assignments:

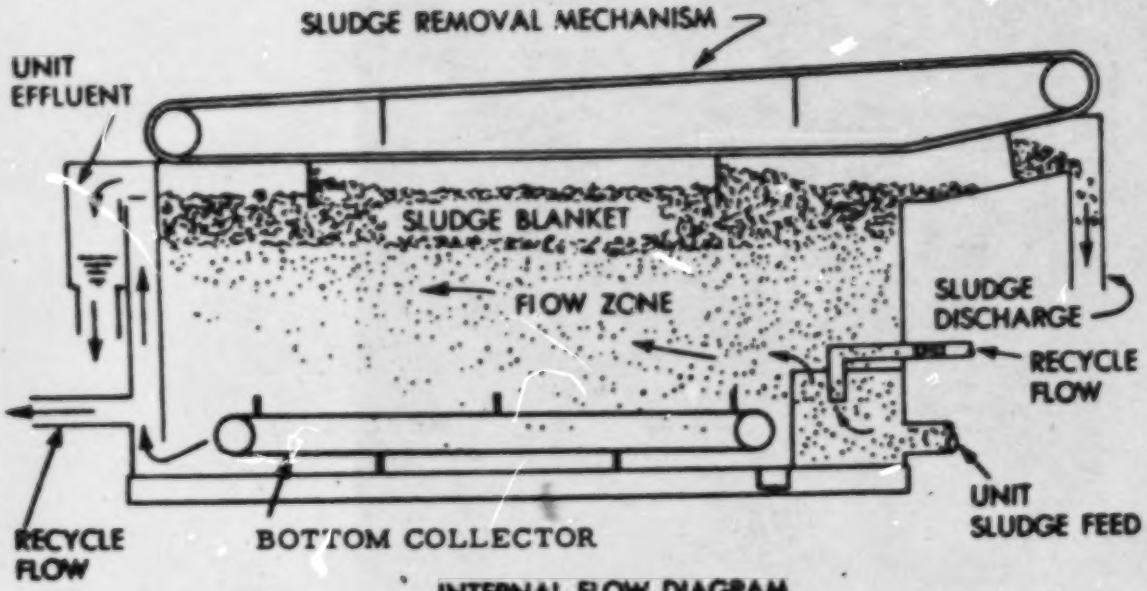
Participate in discussion

Module No:	Topic: Flotation - Grease Separation

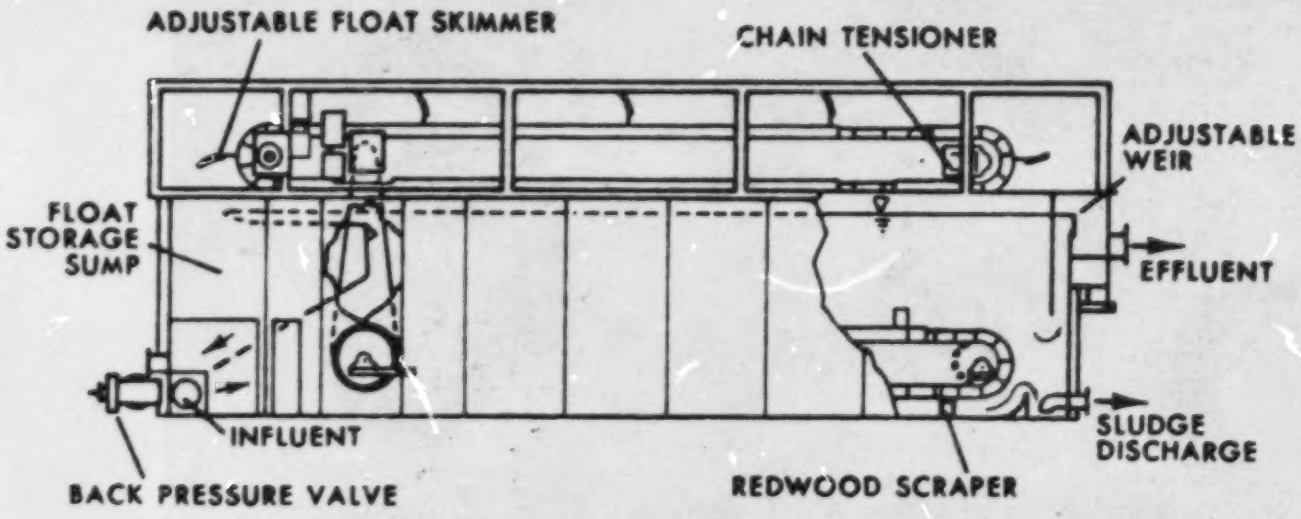
Instructor Notes:	Instructor Outline:
	I. Need and purpose To convert finely divided solids (grease) to floating matter in a shorter period of time and ease of operations. II. Position of equipment A. Ahead of primary settling II. Types
Handouts 1, 2, 3	A. Pressure flotation B. Vacuum flotation C. Flotation



Dissolved air flotation system



INTERNAL FLOW DIAGRAM
H-R TYPE FLOTATION UNIT



Dissolved air flotation unit.

Module No:	Module Title: Preliminary Treatment
	Submodule Title: Flotation/Grease Separation
Approx. Time: 1 hour	Topic: Operation

Objectives:

Upon completion of this module the participant will be able to:

1. Write out procedure of operations to float solids.
2. Identify parts of unit process.

Instructional Aids:

Handout 1, 2, 3

This handout can be used for vacuum method by changing retention tank to vacuum tank.

Instructional Approach:

Lecture
Discussion

References:

1. WPCF MOP #8
2. Manufacturer's Guide
3. Suspended Solids Removal, USEPA

Class Assignments:

Read handout
Participate in discussion

Module No:	Topic: Flotation/Grease Separation

Instructor Notes:	Instructor Outline:
Handout of unit	I. A. 1. Unit equipment Refer to handout for listing. 2. Flotation tank a. Flow enters at bottom b. Scrapers move flotted scum to hopper c. Scum to treatment/disposal 3. Vacuum flotation a. Saturate wastewater with air (aerate) b. Apply partial vacuum in enclosed tank (9 in. mercury). c. Gas dissolved in tank liquid is released; minute bubbles attach to solids causing floating of solids. II. C. Flotation This unit is similar to the primary basin on settling unit. Allows scum to rise at its own rate. Period of retention in the unit is decreased over primary clarification to reduce the quantity of sludge/grit deposition. III. Operation A. Pressure flotation Pressurize the sewage 1 to 3 atmospheres (atm) and release the entire contents to the atmosphere. Dissolved gas in the liquid are released as fine bubbles adhering to the minute solid particles and cause the particle to float. Equate to a soda pop bottle w/compressed CO_2. When opened, the bubbles rise to the surface.

Module No:	Module Title: Preliminary Treatment
	Submodule Title: Flotation/Grease Separation
Approx. Time: 1 hour	Topic: Advantages/Disadvantages

Objectives:

Upon completion of this module the participant will be able to:

1. List three (3) advantages/disadvantages.

Instructional Aids:

Handout 4 (over)

Instructional Approach:

Lecture
Discussion

References:

1. WPCF MOP #8
2. Manufacturer's Guide

Class Assignments:

Read handouts
Participate in discussion

Module No:	Topic: Advantages/Disadvantages

Instructor Notes:	Instructor Outline:

I. Advantages

1. 50% removal of soluble material (grease).
2. 35% removal suspended solids
3. 17 - 35% BOD reduction
4. High overflow rates, low detention periods. Reduced size of equipment.
5. Odor and nuisances minimized
6. Thicker scum/sludge

II. Disadvantages

1. Higher operating costs (pressure and vacuum)
2. High power costs (pressure)
3. Airtight structures necessary (vacuum).
4. Highly skilled maintenance required.

Handout 4

FLOTATION UNITS

Advantages:

1.

2.

3.

4.

5.

6.

Disadvantages

1.

2.

3.

4.

Module No:	Topic:
Instructor Notes:	Instructor Outline:

III. Maintenance

1. Grease chain and sprocket monthly.
2. Maintain oil levels in gear boxes.
3. Clean enclosed tanks (pressure and vacuum) regularly depending on the type of scum and its adherence to tank.
4. Check valves and pipes for leaks.
5. Check motors and vacuum/pressure systems for wear monthly.

IV. Abnormal Operation

Skimmer not removing total quantity of scum

Replace wiper rubber
Adjust wiper rubber

Effluent solids are high
Reduce load to unit

Module No:	Topic: Grease Separation

Instructor Notes:	Instructor Outline:
	Floats sludge too thin - flight speed too high Unit overloaded - low dissolved air V. Safety Keep unit floor area clear and clean of any material (oil, grease, sludge, water). Do not climb on unit. Use provided access areas. Keep hands and clothing free of moving parts.

Module No:	Module Title: Preliminary Treatment
	Submodule Title: Manufacturers
Approx. Time: ½ hour	Topic:

Objectives:

Upon completion of this module the participant will be able to:

1. List several major equipment manufacturers.

Instructional Aids:

Handout 1

Instructional Approach:

Lecture
Discussion

References:

1. Manufacturer's Listing

Class Assignments:

Do handout
Participate in class discussion

Module No:	Topic: Preliminary Treatment

Instructor Notes:	Instructor Outline:
Handout 1	I. Manufacturers of all process equipment Mention of particular manufacturer does not constitute endorsement. 1. FMC 2. Chicago pump 3. Rex 4. Envirotech 5. Dorr-Oliver 6. Wemco 7. Worthington 8. Jeffrey

Handout 1

MANUFACTURERS OF EQUIPMENT

1.
2.
3.
4.
5.
6.
7.
8.

Module No:	Module Title: Preliminary Treatment
	Submodule Title: Disposal of Materials
Approx. Time: ½ hour	Topic:

Objectives:

Upon completion of this module the participant will be able to:

1. List the methods of disposal.

Instructional Aids:

Handout 1

Instructional Approach:

Lecture
Discussion

References:

1. Operation of Wastewater Treatment Plants, Sacramento
2. WPCF MOP #8

Class Assignments:

Do handout
Participate in class discussion

Module No:	Topic: Preliminary Treatment

Instructor Notes:	Instructor Outline:
Handout 1	I. Disposal of Materials All materials collected in each process mentioned can be disposed of in the manner listed below. Check with the local Public Health Dept. Codes for approval. 1. Land disposal - burying 2. Digestion followed by burying or incineratio 3. Incineration followed by land disposal.

Handout 1

DISPOSAL METHODS

1.

2.

3.

Module No:	Module Title: Pretreatment
Approx. Time:	Submodule Title:
	EVALUATION

Objectives:

The participant will score 70% or more on the test provided below.

Preliminary Treatment Evaluation

1. What is the velocity of wastewater in a grit chamber? _____

   A. 0.2 - 0.9 FPM
   B. 0.75 - 1.25 PSI
   C. 10 FPS
   D. 1 FPS

2. Grit is _____.

   A. Sand
   B. Egg shells
   C. Coffee grounds
   D. All of these

3. Types of cleaning methods for a grit chamber are _____.

4. Grit is removed from the flow by _____.

   A. Trucks
   B. Screens
   C. Aeration
   D. Gravity

5. Dewatering devices are for _____.

   A. Dewatering water
   B. Separating grit from water
   C. Increasing plant costs
   D. Increasing plant efficiency

6. Screw classifiers need the submerged bearing greased daily because _____.

   A. The grit will wear out bearings
   B. Plant personnel should support the lubrication companies
   C. Because its there
   D. Prevent the screw from falling out

Module No:	Module Title:
	Submodule Title:
Approx. Time:	EVALUATION

Objectives:

7. The _____ determines the quantity and quality of grit from a cyclone.
8. The purpose of screening is _____.
   A. Remove larger objects from the flow
   B. Prevent damage to expensive equipment
   C. Keep bugs out
   D. None of these
   E. All of these
9. The clear openings of a bar screen are from _____
   A. 2 - 12 feet
   B. 3/4 inches to 3 inches
   C. 2 - 3 inches
   D. All of these
   E. None of these
10. Label diagram of comminuter suppied by the instructor.

    Motor Drum Base Cutters

11. A comminuter and a grinder are different because _____.
    A. The grinder is a grinder
    B. A comminuter is above the flow
    C. A grinder cuts the screens above the flow and a comminuter in the flow
    D. All of the above

Module No:	Module Title:
	Submodule Title:
Approx. Time:	EVALUATION

Objectives:

12. Preaeration is for _____.

    A. Freshening sewage

    B. Odor control

    C. Improves grit removal

    E. All of these

13. Retention time in this unit is _____.

    A. 2 hours

    B. 10 days

    C. 10 - 45 minutes

    D. All of these

    E. None of these

14. There are three types of flotation units, fill in the one missing.

    Pressure

    _____

    Flotation

15. The principle of flotation is similar to a _____ bottle opened.

16. List two advantages of flotation

    A.

    B.

17. List two disadvantages of flotation

    A.

    B.

Module No:	EVALUATION

Instructor Notes:	Instructor Outline:
Answers for test on preliminary treatment. 1. D 2. D 3. Manual mechanical 4. C, D 5. B 6. A 7. Apex valve 8. A, B 9. B 10. see note 10 11. C 12. E 13. C 14. Vacuum 15. Soda pop 16. A. B. See note on question answers. 17. A. B. See note on question answers	10. Diagram supplies by instructor. Use Handout 3 comminuter 16. A. 50% removal of soluble material B. 35% removal of Suspended Materials C. 17% - 35% BOD reduction D. High overflow rates E. Odor and nuisance minimized F. Thicker sludge and scum 17. A. Higher operating costs B. High power costs C. Airtight structures necessary D. Highly skilled maintenance required